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Britain’s Relative Economic Decline in an International Context
1935-1970

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Introduction

1.1 Introduction

This dissertation deals with Britain's relative economic performance in industry during the period 1935-1973, a period commonly referred to as the Golden Age of economic growth (Crafts 1995a; Crafts & Toniolo1995). During those years the world experienced a unique episode of rapid economic growth, especially in Europe and Japan. West Germany had its economic miracle with rapid reconstruction and development, commonly referred to as the *Wirtschaftswunder*. Although the performance of Britain was quite favourable in terms of inflation and unemployment, it was disappointing in productivity and output growth when placed in a comparative international context (Bean & Crafts 1996; Crafts 1995b). GDP per capita in West Germany grew more than twice as fast as in the UK. Whereas the growth rate was 2.4 per cent per annum in the United Kingdom, it was 5.0 per cent in West Germany.[1] There was also a remarkable difference in the growth of labour productivity in the total economy. Labour productivity, as measured by the output per hour worked, grew 3.0 per cent per year in Britain and 5.2 per cent in West Germany (O'Mahony 1999, p.5).

In the literature Britain is commonly compared to West Germany in terms of its relative economic decline. The disappointing performance of Britain can also be seen in Table 1.1, which shows GDP per capita for selected years between 1900 and 1970 for a selection of Western European countries and the United States. In 1900 the United Kingdom had the highest GDP per capita, but by 1950 some countries already had surpassed the United Kingdom, and by 1970 West Germany,

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[1] Own calculations based on Conference Board 2011, Total Economy Database.

France, Norway, Sweden, Switzerland and the United States had overtaken the United Kingdom.

Table 1.1: GDP per capita in selected years (1990 international Geary-Khamis dollars)

Year	United Kingdom	West Germany	France	Norway	Sweden	United States
1900	4593	3134	2849	1762	2561	4096
1910	4715	3527	2937	2052	2980	4970
1920	4651	2986	3196	2529	2802	5559
1930	5195	4049	4489	3377	3937	6220
1940	6546	5545	4004	3718	4858	7018
1950	6847	4281	5221	4969	6738	9573
1960	8571	8463	7472	6549	8688	11193
1970	10694	11933	11558	9122	12717	14854
1980	12777	15370	14979	13755	14935	18270

Source: Maddison (1995), Table D-1a, pp. 194-197.

The idea that Britain was failing in output growth goes back to the end of the 19th century.[2] The British economy allegedly failed in three areas: slow output growth as a result of sluggish demand; imperfect capital markets; and inept entrepreneurs (McCloskey 1970).[3] Near the end of the 1950s and in the beginning of the 1960s a combination of factors, such as the Suez debacle, and the decline of the British empire, led to a climate of declinism (Tomlinson 1996). Especially in the political arena the idea that Britain suffered from profound economic, but also political, social and cultural malaise thrived (Tomlinson 2009). This negative view on Britain's economic performance is picked up by historians and economists alike and particularly the post-war literature is very pessimistic about Britain's economic performance in an international context.

The causes of the divergent growth experiences of Britain, other Western European countries and the United States during the Golden Age is an important topic in economic history. Most studies focus either on broad societal factors, such as the education system, or on economic theory to find an explanation for Britain's alleged failure. Recently, the mainstream interpretation of Britain's relative economic decline has crystallised around the Broadberry-Crafts view and, at its core, the manufacturing failure hypothesis. The most important explanations in

[2] See McCloskey (1970) and Tomlinson (2009) for a detailed discussion on failure in the British economy.
[3] See the work of David Landes for discussions on the failure of British entrepreneurs in Victorian times (e.g. Landes 1965, 1969).

this view are that British industry failed in large-scale operations, Fordist technology, and Chandlerian forms of corporate organisation (Broadberry 1997; Broadberry & Crafts 1992, 1996, 2001, 2003; Broadberry & O'Mahony 2004; Crafts 1996). According to this view, Germany and the United States overtook Britain because of the emerging lead in the manufacturing sector. At the same time, this view hints at failure of the British economy in realizing its growth potential.

The debate on the divergent growth performances and failure of Britain as compared to other advanced countries has been heavily based on data for the aggregate economy, and the aggregate manufacturing sector. However, there are substantial differences in performance across industries. Moreover, failure can be the result of industry specific causes. To obtain an objective indication of whether there was failure in British industry we should investigate this at a disaggregate industry level. Existing disaggregate data on the performance of the manufacturing sector are all derived from extrapolations of distant benchmark years, which implies there can be large deviations from the actual levels of productivity attained in the year of comparison. The debate can continue indefinitely without new productivity data at a disaggregated industry level. We need new measurements of the productivity performance of Britain during the Golden Age, in order to establish which causes were important in British relative economic decline. This dissertation will provide new UK/West-German labour-productivity estimates for both the pre- and post-war period.

A clear definition of failure is needed in order to present a realistic reappraisal of the manufacturing failure hypothesis on relative economic decline. Relative economic decline can be the result of either supply and demand-side factors which make slow growth inevitable, or from failure. Three supply-side theories can be used in explaining British economic decline: (i) catch-up, (ii) reconstruction potential and (iii) structural change. In this dissertation, failure is defined as that part of relative economic decline that cannot be explained by the catch-up potential, reconstruction potential, structural change or demand side factors. Thus, failure means that Britain could have grown faster given the underlying conditions. This failure can be due to institutional explanations, policies and the causes put forward in the manufacturing failure hypothesis. The Broadberry and Crafts view also focuses on the industrial relations system. The degree of competition is also mentioned as a powerful influence on the productivity outcome (Broadberry and Crafts 2003).

1.2 Aim of the dissertation

The main aim of this dissertation is to contribute to the ongoing discussion on Britain's relative economic decline in the first decades after the Second World War by evaluating Britain's productivity performance in an international context. I provide a new labour-productivity estimate at the disaggregate industry level for Britain and West Germany, and I provide a substantially revised estimate for the pre-war period. I focus on the manufacturing sector, since this was the single largest sector of the economy, in terms of employment. More than one-third of all employees in Britain were employed in the manufacturing sector during this period. Important in this regard is how large the impact of the manufacturing sector was on the total economy. Some scholars have argued that the bad performance in manufacturing cannot be held responsible for the overall economic performance, since the sector accounted for 'only' a third of the total economy (Booth 2003a). In contrast, Kitson and Michie (1996) argue that even though manufacturing might be just a part of the economy, there is a substantial effect on the total economy, because of the importance of world trade in goods, and because of the symbiotic relationship between the manufacturing sector and the service sector. Manufacturing relies on transport, finance, insurance etcetera. Hence, the performance in the manufacturing sector will have substantial spill over effects on other sectors of the economy. Moreover, during the post-war period manufacturing contributed by far the largest share of export (Lee 1996). As Lee (1996) states 'domestic manufacturing is vital to Britain's trade performance, the prosperity of her population, and the competitiveness of the non-manufacturing sectors of her economy', (p. 33).

Another reason to focus on manufacturing is that productivity dynamics in the manufacturing sector will be of a different nature than productivity characteristics in other sectors of the economy. Moreover, it is possible to measure the productivity performance in this sector at the most disaggregate level, which enables me to undertake a detailed study. Whereas most research has focused on the aggregate manufacturing level, I use disaggregate information on industries within manufacturing to be able to pinpoint exactly which industries were poorly performing. I use state of the art techniques to compose my labour productivity estimates. By providing these new labour-productivity estimates, this dissertation aims to contribute to the development of answers on the following questions:

1. Which industries contributed most to British relative economic decline?
    - How large was the labour-productivity problem in large-scale operations and Americanisation in British manufacturing?
    - What were the causes of the relatively poor labour-productivity performance in manufacturing and were there alternative trajectories available for British industry?

2. How large were the effects of the British focus on trade with the Commonwealth nations on manufacturing labour-productivity levels?

In the remainder of this chapter I provide a brief literature review on topics which are essential for the rest of this dissertation. First, I discuss the causes of relative economic decline which I label 'inevitable'. These are catch-up, convergence and reconstruction growth, and structural change. Second, I discuss some causes which leave room for specific British failure, namely institutional explanations, macroeconomic policies, and the role of international trade.

1.3 Inevitable causes for Britain's relative economic decline

In this section I discuss the sources of relative economic decline which I like to term 'inevitable causes'. In my view, these causes might have influenced Britain's performance, however, they are beyond reach of the British economic policies and entrepreneurs. As such, these causes explain the relative economic decline, but they do not indicate that Britain was failing.

1.3.1 Catch-up, convergence and reconstruction growth

An important potential source of British relative decline is lower scope for catch-up growth. Several studies pointed out that the United Kingdom had a higher initial level of aggregate labour-productivity, and therefore lacked the potential for rapid catch-up and had much less to gain from the long boom than other European countries (Crafts 1995a, Feinstein 1994). The productivity gap hypothesis, based on the catch-up and convergence models of Abramovitz (1986) and Baumol (1986), states that a country that produces far inside the international technological frontier has more scope to implement innovations that are already in use in the economies of the productivity leaders.[4] Thus, productivity growth tends to be

[4] The idea that economic backwardness may lead to fast catch-up growth goes back to Veblen (1915) and Gerschenkron (1962).

faster in these countries. Abramovitz noted that in the early post-war period all the elements required for rapid growth by catching up -large technological gaps, enlarged social competence and conditions favouring rapid realisation of potential- were in place (Abramovitz 1986, p. 395). Increasing international cooperation through trade and foreign direct investment opened opportunities for European countries to catch up with the United States, which is generally considered to be the world's most productive economy and the productivity leader in virtually every industry after the Second World War (Nelson & Wright 1992).

In the neoclassical model, a country's labour-productivity growth rate tends to be inversely related to its starting level due to diminishing returns to reproducible capital (Solow 1956). However, catch-up can also be considered in an endogenous growth context. In these models catch-up is based on international diffusion of technology and reduced technology gaps between countries. Catching up during the Golden Age was in part the result of technology diffusion. Possible mechanisms include licensing of process and product development, foreign direct investments, and straightforward copying (Dowrick & Nguyen 1989). An increase in technological competence is confirmed by quantitative research of Verspagen (1996), who used data on patents licensing and R&D expenditure to proxy technological advancement. His results indicate that for the United Kingdom the contribution of technology to labour productivity growth was not substantial. The average annual growth rate of labour productivity during the period 1960-1989 was 2.46 per cent and the contribution of technology ranged from 0.01-0.21 per cent points (Verspagen 1996, p.233). For Germany on the other hand, the contribution of technology was quite high, ranging from 0.10-1.33 per cent point of the average annual labour productivity growth rate of 3.31.

Especially German studies ascribe the German *Wirtschaftswunder* to reconstruction growth (Cairncross 1951; Dumke 1990; Smolny 2000; Wallich 1955). In this view, a part of West-German's super-growth as compared with Britain might be the result of the setback Germany experienced as a result of the Second World War. To assess whether West Germany did indeed have more scope to catch up than Britain, a complete account of industrial performance at the disaggregate level is required. A couple of labour-productivity comparisons between Germany and the United Kingdom exist for the early post-war period. However, there is no consensus on the relative productivity levels of these two large economic players at the start of the Golden Age. According to Broadberry (1998) the two countries were almost on a par, whereas estimates by Van Ark (1990, 1993) and O'Mahony (1998) suggest that labour productivity levels in

Germany were much lower than in the United Kingdom. The existing estimates are all based on extrapolations from benchmarks in different years.

In this dissertation I construct a new industry-of-origin benchmark for the year 1951 and I find that Germany's labour productivity in manufacturing was around 87 per cent of Britain's productivity in terms of value added per hour worked. To assess whether the impact of catch-up and convergence and the reconstruction potential are important in explaining Britain's relative economic decline, a labour-productivity estimate for the pre-war period is needed. To obtain a methodological consistent estimate for the pre-war period, which is directly comparable with the 1951 estimates, I modify the existing 1935 labour-productivity estimates of Fremdling, de Jong and Timmer (2007). My new labour-productivity estimates are the first ever constructed methodologically consistent, disaggregate estimates for West Germany and the United Kingdom for the pre- and post-war period. I find that West Germany was ahead of Britain by 11 per cent in manufacturing, as measured by value added per hour worked, in 1935. By 1951 West Germany was at 87 per cent of the British productivity level. Examining both the pre-and post-war estimates reveals that West Germany lost some ground during the war period. This productivity gap indicates that West Germany had indeed much more scope for catch-up and reconstruction growth than Britain. Hence, the faster growth of West Germany compared with the British economy is not necessarily a sign of British failure.

1.3.2 Structural change

Several scholars, such as Kaldor (1966) and Denison (1967), have stressed the importance of growth of an abundant supply of labour, originating through the release of workers from the agricultural sector. According to Broadberry (1997) the overtaking by the United States and West Germany of the United Kingdom was mainly a result of sectoral shifts outside the manufacturing sector. In West Germany still 22.2 per cent of the labour force was employed in agriculture after the Second World War (Maddison 1991, p.248). West Germany's slow exit from peasant agriculture kept the economy away from the efficient frontier (Eichengreen & Ritschl 2009). The great reservoir of labourers could be transferred from the relatively low productive agricultural sector to the much more productive industrial sectors, leading to fast productivity growth (Temin 2002; Temple 2001). In the United Kingdom however, the share of labour in agriculture was only 5.1 per cent at the start of the Golden Age, and hence there was much less potential for structural change (Maddison 1991, p. 248).

The industrial structure of the United Kingdom and the United States was very similar in the beginning of the 1950s. This is in line with the fact that both the United Kingdom and the United States made the transition from agriculture to the service sector at a much earlier date than in West Germany. Temple (2001) used growth accounting to quantify the importance of structural change in explaining the variation in productivity levels during the Golden Age for the United States and Western Europe. He estimated that labour reallocation typically accounted for one-tenth to one-seventh of growth in output per worker between 1950 and 1979. Structural change is thus capable of explaining part of the divergent growth paths of West Germany and the United Kingdom during the Golden Age.

According to Kaldor (1966), Verdoorn’s law, stating that labour productivity growth is a positive function of the growth in employment, operated in the manufacturing sector in the post-war period in Europe. Obviously, only countries which had a reserve of labourers could benefit from this type of dynamic economies of scale. This implied that Britain was bound to experience lower growth as compared with countries as West Germany, since it did not have a reservoir of labourers available. Kaldor found a statistically significant, positive relationship between productivity growth rates and employment growth in the manufacturing sector for the period 1953-1954 to 1963-1964. However, his results are far from undisputed. Rowthorn (1975) was able to show that it seems very unlikely that Verdoorn’s law operated in Europe in the post-war period. He argues that Kaldor used misleading statistical techniques, and chose his sample based on some extreme cases.

Table 1.2: Sectoral shares of employment in the UK (percentages), 1920-1965

Sector	1920	1925	1930	1935	1938	1948	1950	1955	1960	1965
Agriculture forestry and fishing	8.58	8.48	7.64	6.84	5.94	5.22	5.09	4.49	4.09	3.31
Mining and quarrying	6.53	6.48	5.41	4.34	4.22	3.84	3.69	3.58	3.12	2.45
Manufacturing	35.51	33.50	31.73	31.88	32.54	33.78	34.90	35.91	36.27	35.48
Construction	4.57	4.97	5.41	5.69	5.91	6.46	6.33	6.35	6.59	7.41
Utilities	0.91	1.07	1.20	1.31	1.36	1.42	1.54	1.58	1.53	1.63
Transport and communication	8.08	8.38	8.34	7.88	7.90	7.96	7.90	7.22	6.93	6.61
Government	6.88	5.11	5.18	5.25	5.76	9.94	8.83	8.53	7.28	6.83
Distributive trades	11.59	12.48	14.25	14.80	14.43	11.85	12.19	12.80	13.65	13.62
Finance and services	17.35	19.53	20.82	22.01	21.94	19.54	19.52	19.54	20.53	22.68

Source: own calculations based on Feinstein (1972), Table 59, p.T129.

Table 1.2 presents the sectoral shares of employment for Britain for the period 1920-1965. This sectoral breakdown shows that the manufacturing sector in Britain did not change much in size in terms of employment. During the interwar period the sector became somewhat smaller, but after the Second World War it grew to over 35 per cent of total employment again. Although this means that almost two-third of all employees was not employed in manufacturing, manufacturing remained the single largest employer. Table 1.3 displays the share of manufacturing output in GDP in constant 1963 prices. The share of manufacturing output in GDP was higher in 1970 than in 1950. There was no deindustrialisation going on during this period.

Table 1.3: Share of manufacturing output in GDP in constant 1963 prices (1950-1970)

	UK	West Germany
1950	29.1	39.7
1951	29.2	41.4
1952	28.2	40.7
1953	28.7	40.6
1954	29.5	41.1
1955	30.3	41.7
1956	29.7	41.4
1957	29.8	41.1
1958	29.3	41
1959	29.9	41.2
1960	30.8	42.2
1961	29.9	42.4
1962	29.8	41.2
1963	29.7	41.4
1964	30.6	42.1
1965	30.9	41.3
1966	30.9	40.5
1967	30.3	41.9
1968	31.3	42.7
1969	32	42.7
1970	31.4	41.4

Source: Brown and Sheriff (1979), Table 6, p.8.

Table 1.4 presents data on the growth in output per hour worked in different sectors of the economy. When we observe the growth rates for the United

Kingdom, it appears that utilities experienced the highest growth in output per hour worked. However, given the very small size of this sector, which employs less than two per cent of all employees, this will not add much to the growth of the total economy. Agriculture also shows higher growth rates than manufacturing, but this sector was also relatively small during the period 1950-1970. Growth rates in finance and services, important sectors, are relatively low, especially when compared with West Germany and France.

Table 1.4: Growth in output per hour by sector in the UK, West Germany, the US and France (percentage per annum), 1950-1973

Sector	United Kingdom	West Germany	US	France
Agriculture forestry and fishing	5.22	6.89	4.65	6.24
Mining and quarrying	2.23	7.10	3.81	6.22
Manufacturing	4.69	6.62	2.76	5.85
Construction	1.72	4.17	0.80	2.98
Utilities	6.09	7.02	5.49	9.55
Transport and communication	3.22	4.75	2.86	5.54
Distributive trades	2.76	4.80	2.29	3.20
Financial and business services	0.95	4.80	0.79	3.61
Miscellaneous personal services	2.20	6.42	1.53	2.83
Non-market services	0.04	3.40	0.39	2.32
Total economy	2.99	5.18	2.34	4.62
Market sectors	3.38	5.44	2.74	5.25

Source: O'Mahony (1999), Table 2.2, p. 14.

Broadberry (1998, 2004) claims that the US and West-German overtaking of Britain, in terms of aggregate labour-productivity, was mainly the result of a shift from labour out of agriculture and of a comparative productivity increase in the service sector. Britain was very efficient in the service sector giving scope for West Germany and the United States to catch up. Broadberry (1998) also states that if manufacturing contributed to the overtaking, it was through the effects of structural change. This is in line with Abelshauser's (2004) claim that West Germany over-industrialised in the early post-war period. The reason why West Germany and the United Kingdom have a different size of industrial sector is because the specialisation structure of the countries is different. During the Nazi-period and the post-war reconstruction West Germany's specialisation in industry became even stronger. According to Germany's official statistics the industrial sector -that is manufacturing, mining and utilities, and construction- accounted for

44.4 per cent of West-German GDP in 1950. This share grew to 51.4 per cent in 1955 and 53.6 per cent in 1960 (Statistisches Bundesamt 1973; 1991). When we consider this high level of industrialisation of West Germany, Britain's performance does not need to be considered as failure, since it was simply not able to grow at German rates because of a more service based economy over the 1950s and 1960s. Labour-productivity growth rates in the service sector have been lower than growth rates of labour productivity in the industrial sector throughout the Golden Age in every country (Maddison 1987, p. 684).

Table 1.5: Growth rates in GDP per man-hour and GDP per capita in West Germany and the United Kingdom, 1938-1973

	West Germany	United Kingdom
	Annual growth rate of GDP per hour worked	
1938-1950	-0.41%	2.25%
1950-1960	19.47%	12.56%
1960-1973	5.22%	3.88%
	Annual growth rate of GDP per capita	
1938-1950	-1.49%	1.13%
1950-1960	7.05%	2.27%
1960-1973	3.45%	2.62%

Source: Own calculations based on Maddison (1995), Table D-1a and Maddison (1991) Table C.11.

The annualised average growth rates of GDP per capita and GDP per hour worked in the United Kingdom and West Germany are presented in Table 1.5. The difference between GDP per capita and GDP per hour worked is for a part the result of variance in the employment to population ratio in the two countries. Between 1950 and 1960 the difference in the growth rate of GDP per capita was much larger than the gap in the growth rate of GDP per man-hour. Thus, GDP per capita growth in West Germany in this period cannot be completely explained by productivity growth. A vital role is played by labour force expansion in West Germany stemming from immigration, increased labour participation and movement of labour out of agriculture.[5] The idea that German super-growth is partly caused by labour force expansion, is in line with the idea of Kindleberger (1967). Kindleberger argues that labour-supply flexibility exerts downward pressure on the growth rate of real wages, thereby raising the level of investment

[5] Germany's unemployment rate was high in the beginning of the 1950s, 8.2 per cent of the total labour force was unemployed. In the United Kingdom unemployment was low with only 2.5 per cent. Around 1960 both Germany and the United Kingdom were at full employment.

and thus output. Quantitative work by Vonyó (2008) has shown that different rates of labour force growth indeed matter for economic growth.

Research by Crafts (1992) showed that the United Kingdom underperformed by 0.5 to 0.7 percentage points after allowing for the different scope in catch-up, reconstruction and the initial structure of employment. Hence, there is ample room for other explanations in the debate on Britain's relative economic decline.

The contribution of my dissertation is that I evaluate the performance of British industry at the disaggregate industry level, which allows me to evaluate in detail which explanations are useful in explaining Britain's performance at the industry level. Especially Americanisation and institutional explanations might be industry dependent. Hence, investigating the entire manufacturing industry as a whole will not reveal the impact of these causes.

1.4 British failure

A key element in this dissertation is the definition of failure. British economic history literature is filled with the alleged failure of Britain in economic performance. However, what is often lacking in these works is a clear definition of failure. I believe we cannot state that Britain failed in industrial output, simply because it is less productive than other countries. We should take supply and demand conditions into account to assess whether industrial choices made make economic sense. When we label the British performance as failure, this should mean that Britain had the option to take control over the causes of this failure. Below I discuss some potential causes of failure.

1.4.1 Institutional explanations

Some scholars have attributed the relative decline of the British economy to rigidities in social and economic institutions, or to the institutional framework. In the well-known view of Mancur Olson (1982) stable democracies accumulate sectional interest groups over time, whose actions as vested interests slow the rate of catch-up. The two World Wars and post-war trade liberalisation might have temporarily reduced the strength of the sclerotic tendencies and therefore might explain both the Golden Age and the different growth experiences during this period. Proponents of this 'institutional view' stress that in countries, such as the United States, West Germany and Japan, successful economic development has been based on the adoption of mass-production techniques and corporate forms of managerial coordination (Elbaum & Lazonick 1984). In Britain however, labour market organisations were traditionally decentralised with relatively weak central leadership and the adoption of these modern technological and organisational innovations were impeded by this rigid institutional structure inherited from the nineteenth century.

Olson's hypothesis has been heavily criticised by two groups of scholars. The first group consists of those who deny the destruction of interest groups during the war (Grant, Nekkers & Van Waarden 1991). Paqué (1995) argues that in its most fundamental legal, political and economic characteristics, the Federal Republic of Germany was a descendent of Weimar, and Nazism and Allied occupation only represented a pause in an otherwise continued tradition. The impact of these latter two on the institutional framework of West Germany is not larger than the impact of the Weimar republic, since all great institutional transformations had happened in earlier times. Booth, Melling and Dartmann (1997) also claim that in German institutions significant continuities have been observed after the Second World War, partly caused by the fact that allied military authorities used local employer organisations to restart production, leaving little room for the hypothesis of institutional shake-up. Eichengreen and Ritschl (2009) share this view. The second group of criticisers consists of those who included an 'institutional sclerosis variable' in standard convergence regressions and found no explanatory power of this variable (Castles & Dowrick 1990).

Eichengreen (2007) provides a full account of the episode of 'coordinated capitalism' in which institutions and especially neo-corporatist bargaining between employers, trade unions, and governments were an important factor in catching up. He argues that post-war European countries implemented institutional arrangements that promoted high investment by firms in return for wage restraint by workers, leading to high growth, which was advantageous to both sides.

Although the aim of this dissertation is not to add to the literature on institutional explanations of Britain's relative economic decline, it will be important to take the institutional framework into account in the analyses I perform with my new labour-productivity estimates. When necessary I will mainly draw on secondary sources to discuss the importance of specific institutional factors which might have had an influence on the allegedly poor performance of certain industries.

1.4.2 Macroeconomic policies

Macroeconomic policies can play an important role in economic growth via their influence on important economic determinants.[6] In the early post-war period, economic policy in Britain relied heavily on direct control to cope with balance-of-payment problems. Even in 1951, 54 per cent of imports and 41 per cent of industrial raw materials were still controlled, and 40 per cent of consumer spending was on price-controlled items (Broadberry & Crafts 1996, p.15). The main hypothesis about British economic policies is that although they were helpful in the short run in achieving lower inflation and unemployment, they inhibited productivity growth (Crafts 1995b). Abramovitz (1986, p. 390) stated that catch-up growth is not automatic, but '*the pace at which potential for catch-up is actually realized in a particular period depends on factors limiting the diffusion of knowledge, the rate of structural change, the accumulation of capital and the expansion of demand*'. In the early post-war period British industry was characterised by restrictive competition and collusion. Levels of concentration were very high (Hannah 1983). Domestic producers were protected by tariffs, there was no free trade and thus no perfect competition. The 1956 Restrictive Practices Act required that all collusive agreements were registered. The Act itemised six so-called 'gateways' through which a public interest exemption could be obtained. Elliot and Gribbin (1977) estimated that in 1958 over 54 per cent of output in manufacturing was subject to cartel regulations, and in sectors such as metal manufacturing, electrical engineering and construction materials this share was over 75 per cent.

Broadberry and Crafts (2001) find little support for the Schumpeterian hypothesis of a positive relationship between market power and innovation in 1950s Britain. Competition policy appears to have been much too lenient but the productivity problems of British industry are best viewed as arising largely from difficulties of reaping the benefits of innovation. Broadberry and Crafts (1996) showed that concentration and cartelisation lowered productivity growth. In their 2001 paper they find that concentration and collusion did not have a significant adverse effect on innovation. This suggests that the problems of British industry at

[6] Labour market policies can affect economic performance through its impact on unemployment. Competition and trade policy influence the availability of rents to be appropriated via restrictive practices. However, in new endogenous growth models the effects of macroeconomic policy on national growth is thought to be only modest. See Easterly 2005 for an overview of economic models that predict strong policy results and an econometric approach estimating the effect of macroeconomic policies on economic growth. Easterly found that policies indeed affect economic growth, but only when policy variables take on extreme values.

this time arose largely not from failure to innovate, but rather from difficulties in converting those innovations into higher productivity.

Whereas in the British literature there is much critique on the decisions governments made, German literature is much more positive about the influence of West-German policies on the productivity performance. In Germany the impressive growth record in the 1950s and 1960s has been -until the 1980s- seen as a consequence of economic liberalisation and the introduction of the social market economy after 15 years of tight planning and state interventionism under the Nazi regime (Reichel 2002).

In my dissertation I will not bring up new evidence on the macroeconomic policies which affected labour-productivity during the post-war period. It is however, important to take the macroeconomic environment into account during the analysis which will take place in later chapters.

1.4.3 The role of international trade in manufacturing productivity growth

The final chapter of this dissertation will focus on the effects of openness and international trade on labour productivity in manufacturing. The Golden Age of economic growth was in essence a period of protectionism in Britain, tariffs remained at their 1930s level through the mid-1960s, and the median tariff in Britain was twice as high as in West Germany in the late 1950s (Crafts 2012). Britain did not become a member of the European Economic Community (EEC), and this is seen by some as an important setback in the field of competition. According to Broadberry and Leunig (2013) an important reason for Britain’s sluggish productivity growth in the post-war period, as compared with for example West Germany, was the isolation of British firms from foreign competition. European nations had relatively similar economic structures during this era, which means that firms in each country could compete with each other in a potentially vigorous manner. Britain however, was still trading with the Commonwealth, but these economies were complementary to each other, and hence intra-industry competitive pressure was lowered. Competition is traditionally an important topic in the British debate on relative economic decline.[7]

[7] See for example Broadberry and Crafts 2001; Crafts 2012.

1.5 Outline of the chapters

Chapter 2

Chapter 2 contributes to the discussion in the literature by providing quantitative information of Britain's relative position vis-à-vis Germany in the interwar period, in the post-Second World War period, and near the end of the Golden Age. In this chapter, I present new estimates of British-German comparative levels of labour-productivity in manufacturing. I apply the so-called industry-of-origin approach, and by using industry-specific purchasing power parities I am able to convert German and British output values to a common currency. This method has been applied in an UK/German study for the year 1935 but not for the year 1951. I also adapt an existing labour-productivity estimate for the interwar period from Fremdling, de Jong and Timmer (2007), to make it methodologically consistent with the post-war estimates. Fremdling et al. compared the German Reich with the United Kingdom, whereas for the post-war period we can rely only on data for West Germany. I adjust their estimate so that it only takes West Germany into account. Moreover, I adjust for hours worked. It is important to take hours worked into account, since the length of the workweek and the number of holidays varied significantly between West Germany and the United Kingdom during this period. If we would not take this difference into account, we would overestimate the productivity level of the United Kingdom, since it reported significantly higher annual hours worked than West Germany. These two methodologically consistent benchmarks allow me to analyse how Britain was performing relative to West Germany over the course of the Second World War. Finally, I use an existing German/UK labour-productivity comparison for 1968 to analyse how the UK/German productivity race advanced over the Golden Age. I create a new and consistent view for the trans-World War Two period and the Golden Age. In the mid-1930s, West Germany commanded a respectable lead over the United Kingdom in industrial labour productivity. West Germany appeared to be especially productive in metallurgy. My data show that by the early 1950s, this pattern had been completely reversed. Relative to the corresponding British level, value added per hour worked in West Germany industry declined by thirty per cent between 1935 and 1951. But by 1968 West Germany had overtaken the United Kingdom and regained its position as local leader in manufacturing efficiency.

Chapter 3

Chapter 3 deals with the question to what extent there was indeed failure in the British manufacturing sector. Utilizing the new labour-productivity estimates constructed in Chapter 2, I apply decomposition techniques to evaluate to what extent each industry within manufacturing was responsible for the aggregate gap between West Germany and the United Kingdom in manufacturing. This analysis provides new insights in the productivity dynamics in the manufacturing sector of the United Kingdom. My new findings shed more light on the big questions concerning the economic performance of Britain, and I am able to demonstrate that some arguments used in the literature should be rethought. My conclusions on the timing of the West-German overtaking of the British productivity level are different from what previously has been argued in the literature.

Shift-share techniques are applied to evaluate the effect of structural change within the manufacturing industry. I find that the structure of industry is remarkably similar in Britain and West Germany.

Although the reconstruction thesis is often mentioned in the German literature as an important explanation for the West German *Wirtschaftswunder*, it obtained much less attention in the British literature. In this Chapter I focus on the role of the reconstruction thesis for West German growth. I show that West Germany was bound to achieve higher growth rates as a result of the war induced gap in productivity.

In the second part of Chapter 3 I focus on the presumed failure in large scale operations and Americanisation. Britain has been criticised for failing in large-scale operations and plants, and in this chapter I evaluate at a disaggregate level in manufacturing the size of establishments and relative productivity. The data I have used here reveal that in many cases the large plants were more productive than average-sized plants. This is in line with the conclusion of Booth (2003a), who argued that there is not really any failure in large-scale operations.

Chapter 4

In Chapter 4, I examine to what extent international openness and trade have contributed to disappointing labour-productivity growth rates in the United Kingdom after the Second World War. Although trade and openness are discussed in the literature as potential explanations for Britain’s relative economic decline, not much quantitative evidence is available. This chapter attempts to fill this lacuna by creating new data which can be used to investigate the effect of trade on labour-productivity in manufacturing.

Britain was once the major trading country of the world. Until the First World War tariffs were so low that there was virtually a situation of free trade. In 1937, just before the outbreak of the Second World War, Britain was still the number one exporting country in the world. However, after the war it lost this position to the US, and by 1958 West Germany took the second position. In the literature on trade and openness there have been many debates on the effect of trade characteristics on productivity growth. Although theoretically the links are not completely clear, and causality might run from trade to growth and vice versa, there is an overwhelming amount of empirical literature that has shown that trade can indeed have a pronounced effect on the growth rate of a country. In this chapter I evaluate whether trade had an effect on the labour-productivity growth rate in British manufacturing at a disaggregate level. I find that more trade indeed would have led to higher labour-productivity growth. This implies that if Britain would have been more open during this period, it could have achieved higher labour-productivity growth rates in manufacturing. Hence, Britain’s choices towards international trade liberalisation have played a role in its relative economic decline.

In the second part of this chapter I evaluate the evolution of Britain’s trade pattern over the course of the Golden Age. I examine whether the geographical origin of trade has affected labour-productivity growth rates. I distinguish between the Sterling area, which included the Commonwealth countries, and more advanced nations such as the United States. I find that indeed trade with more advanced countries had a more pronounced effect on labour-productivity growth rates than trade with less advanced countries. This indicates that the British productivity performance might have been better should Britain have traded more with Europe and the United States instead of the Sterling area.

Chapter 5

Chapter 5, the final chapter, will summarise the results of this dissertation.

Chapter 2

Measuring long term productivity patterns: comparative labour-productivity benchmarks for Britain and West Germany in 1935, 1951 and 1968*

2.1 Introduction

The notion of relative economic decline has long pervaded British historiography, to the extent that Tomlinson (1996) called this strand of the literature ‘declinism’. The previous chapter introduced British relative economic decline during the Golden Age of economic growth, and discussed the various theories and hypotheses brought up in the debate. The growth record of the United Kingdom during the post-war Golden Age of economic growth has been studied most frequently in a West-German comparison. The inability of British industry to achieve anything close to West-German super-growth in the 1950s and its worsening market position in the face of surging West-German exports was often linked to Olsonian arguments about the punishment of wartime victors with the legacy of bad institutions inherited from the interwar period (Elbaum & Lazonick 1984; Kirby 1992; Olson 1982). More recently, the mainstream interpretation of Britain’s relative economic decline has crystallised around the Broadberry-Crafts view and, at core, the so-called manufacturing failure hypothesis. The most

* I greatly acknowledge the extremely helpful discussions with Tamas Vonyó.

important explanations for manufacturing failure in these view are that British industry failed in large-scale operations, Fordist technology, and Chandlerian forms of corporate organisations (Broadberry 1998; Broadberry and Crafts 1996; idem 2003; Broadberry and O'Mahony 2004; Crafts 1996). Clearly, the United Kingdom was bound to achieve more modest growth rates in industrial productivity, as it was already closer to the productivity frontier, which is generally assumed to be the US, after the war. However, as shown by Crafts (1995), annual growth rates were still substantially lower than what could have been realised based on the convergence hypothesis.

German scholars put great emphasis on the role of the war-induced gap between actual and potential output that, according to many, was the chief catalyst of the *Wirtschaftswunder*. According to the reconstruction thesis West Germany was bound to have higher productivity growth rates, since destruction of physical capital and underinvestment in new equipment and plants during the war induced a mismatch between labour and capital after the war.[1] As long as West Germany was not back on its pre-war growth trajectory the super-growth experienced does not imply that Britain was failing, since growth rates there were substantially lower. The reconstruction thesis is confirmed econometrically in cross-country investigations.[2]

In my reassessment, I quantify both factors, catch-up and reconstruction growth, and discuss their contribution to the relative decline of British industry during the Golden Age. This approach requires additional data that go beyond the currently available time-series evidence on productivity growth. We need information on how much West Germany was lagging behind Britain in industrial labour productivity at the start of the Golden Age and how large the impact of World War II was on the relative productivity position of both economies. To quantify this process I construct two methodologically consistent labour-productivity benchmarks for the industrial sector in Britain and West Germany for the mid-1930s and the early 1950s.

My 1951 benchmark is the first direct disaggregate comparison of industrial labour productivity levels between the two economies at the start of the Golden Age. All existing estimates have been derived by extrapolation from distant

[1] The reconstruction thesis is attributed to Jánossy 1969. On its implication for West-German economic growth in the 1950s, see Abelshauser 2004, and Eichengreen & Ritschl 2009. The low initial capital-labour ratio leads to high returns on capital, inducing high levels of investment and thus securing rapid productivity growth. As long as the capital to labour ratio is not restored to its optimal long run level, capital accumulation does not experience diminishing returns. Countries will experience rapid growth until they are back on their potential growth path.

[2] See Dumke 1990, and Vonyo 2008.

benchmarks using time-series data, which cannot take account of inter-temporal changes in relative prices and product weights.[3] Moreover, these estimates are not as disaggregated as the one I construct. As for the mid 1930s, the currently available benchmarks all report relative levels of labour productivity for Britain and Germany within interwar borders, and thus are not directly comparable with post-war productivity data. I present a substantially revised benchmark for 1935, drawing on the work of Fremdling, de Jong and Timmer (2007) while assuring territorial and methodological consistency with my 1951 benchmark.[4] I use the same industry classification for both the 1935 and 1951 benchmarks to make them fully comparable. Moreover, I add coal mining to the comparison. Lacking in virtually all other basic raw materials Germany was much more dependent on coal than most other industrialised nations. More than 90 per cent of the energy consumed in Germany in 1937 was derived from coal. Therefore, this is an important branch to include in the comparison. Additionally, I use an existing 1968 labour-productivity estimate from Smith, Hitchens and Davies (1982) to evaluate how Britain and West Germany were performing relative to each other near the end of the Golden Age.

Perhaps the weakest point common to most scholarly contributions to the debate on Britain's relative economic decline and its failure has been the absence of a clear definition of failure, or at least its meaning in a theoretical framework. I argue that the concept of growth failure is difficult to interpret at the macro level; it needs to be specific to particular industries where particular technologies or modes of labour organisation need to be adopted to improve productivity. This implies that one can only provide for an adequate account of British manufacturing performance at the industry level. To serve this purpose, my two benchmarks are significantly more disaggregated than all previous estimates. A richer data set also allows me to better test for the existing explanations of German super-growth and Britain's relative economic decline after 1950.

In this chapter I am solely concerned with productivity, especially labour productivity. I define labour productivity as value added per working hour. This is known as single factor productivity or partial productivity (Van Ark 1990, p.5). Labour-productivity differences between countries can occur for a variety of reasons. The most obvious reasons for differences are that countries might use different amounts of other inputs or factors of production, such as capital. Labour

[3] Estimates for aggregate manufacturing are provided (based on extrapolations) by Broadberry 1998; O'Mahony 1999; Van Ark 1990; and Van Ark 1993.

[4] I kindly thank Fremdling, de Jong and Timmer for granting me access to their database, without being able to use their product matches this work would have been very difficult.

quality can also greatly differ between countries. Moreover, countries might differ in their degree of efficiency.

A valid question would be why I focus on productivity only when I want to investigate a country in relative decline. One might argue that to get a complete picture of how the British economy was performing after the Second World War and throughout the Golden Age, I would want to look at indicators of standards of living, such as perhaps indicators of the quality of life. According to Nobel laureate Paul Krugman (1994, p.13) *'Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker'*. Krugman claims that the only sustainable way of achieving long-term growth in living standards is via increased productivity. Other options to raise output, such as employing a larger part of the population, or investing less, are only short-term solutions to achieve higher consumption. In the long-run, we need productivity growth to achieve higher living standards. Thus, in this chapter the focus will be on productivity, in an attempt to resolve some of the issues in the debate on British relative economic decline.

In the next section I will discuss the methods available for constructing labour-productivity benchmarks and I explain the methodology I use. Section 2.3 discusses the data utilised in the construction of the labour-productivity benchmarks. I will first present and discuss the 1951 benchmark, and after that the 1935 estimates. For 1951 I construct a complete new labour-productivity estimate, which allows me to discuss all the steps needed in the construction. For 1935 I revise on an existing estimate. Section 2.4 presents the results of the 1951 benchmark, and in Section 2.5 the revised 1935 benchmark is presented. Section 2.6 introduces an existing 1968 productivity estimate. The productivity estimates allow me to present a detailed case-study of the relative performance of the engineering sector in the United Kingdom and West Germany in Section 2.7. The engineering sector provides a good example of how labour-productivity estimates can be used to evaluate the performance of an industrial sector between two countries. Section 2.8 summarises and concludes.

2.2 Methodology for the construction of labour-productivity estimates

Productivity comparisons are closely related to the core of economics and have a long history. Already at the end of the seventeenth century Sir William Petty (1690) constructed a study which compared wealth between the leading nations, France, England and Holland. A few years later a study based on expenditure and production information from national accounts was published (King 1696). The most well-known work on productivity comparisons across countries is probably the work of Angus Maddison (1995, 2001), which covers a wide range of countries and has a long time span. Multiple methodologies have been applied in the construction of labour-productivity estimates. In the next section I will explain the merits and drawbacks of the different methods and I argue that the so-called industry-of-origin approach is most suited for the historical comparisons I make.

2.2.1 Different approaches to construct productivity comparisons

The first step in conducting a productivity comparison is finding an appropriate converter to translate the value of output in different countries into a common currency. An obvious candidate would be the exchange rate. However, exchange rates might not reflect the correct overall purchasing power parity (PPP) between the currencies under consideration; therefore, they are not suitable for a productivity comparison. Exchange rates fail to take into account that the purchasing power of a currency will normally differ for different products, and usually only hold for the tradable part of the economy. Moreover, capital movements can play a key role in the determination of official exchange rate levels and can lead to fluctuations. Even for output as a whole the exchange rate can be off by a factor of three or more according to Kravis and Lipsey (1991, p.437); for individual products the deviation may be even more severe. Another obvious candidate for the purpose of converting values of output into one currency would be the Purchasing Power Parities (PPPs) as calculated by the International Comparison Program (2005). However, these PPPs are designed for expenditure comparisons and will lead to biased estimates when applied to constructing comparative productivity levels. Expenditure PPPs include relative transport and distribution margins and foreign prices, moreover, they are usually expressed at market prices. The problem with market prices is that these are influenced by the level of value added taxes and excise duties, which are difficult to subtract from the sales price unless very detailed data on these items is available. Thus, expenditure PPPs are not suited for a sectoral-productivity comparison as I wish to make.[5] Rostas (1948) was the first to compare real output and productivity from the production side of the economy. He provided a comparison of productivity for

[5] ICP's PPPs have been used for productivity comparisons of the total economy, most notably in the work of Angus Maddison, see e.g. 1991.

the United States, the United Kingdom and Germany for 1936.[6] He applied the so-called 'industry of origin' approach. This approach aims at comparing levels of output by industry, rather than comparing expenditure categories.[7]

Most of the existing pre-1945 benchmarks are based on a direct comparison of physical output per worker. The post-1945 benchmarks are generally obtained using the methodology laid out by Paige and Bombach (1959). The major novelty of the Paige and Bombach study was the use of data on net output available in national census data. Net output is defined as gross output minus the costs of materials and fuel used and the amount paid to industrial services. Production censuses usually provide data on both the quantity of sales in physical units and the value of these sales. Hence, the factory-gate price or unit value of a product can be obtained through dividing the value of sales by the quantity sold. Paige and Bombach converted values in different currencies by using derived unit values from national production census data. Both the direct comparison method and the method of Paige and Bombach offer a solution for the problems that plagued earlier research, which used the exchange rate to convert values of output in different currencies.[8]

Recently two studies on comparative labour-productivity in the early twentieth century, based on the industry-of-origin approach, were published (see Veenstra 2014; and Woltjer 2013).

2.2.2 The industry-of-origin approach

In this study, I employ the industry-of-origin approach that uses unit values to convert values of output into a common currency. A unit value represents the average price for a product, or a group of similar products. Product prices are usually not available in production censuses, hence they have to be derived on the basis of data on the produced value and the quantity of products. This implies that the unit value is based on the price of products averaged throughout the year and over all producers. Unit value ratios are the most appropriate indicator for price comparisons in manufacturing (Van Ark 1990). An advantage of using the unit-value method is that production censuses also provide data on sectors that produce mainly intermediate inputs. Important and large industries such as for example blast furnaces, paper and pulp, and basic chemicals do not produce for final

[6] Germany is only included in the comparison for mining, railways and agriculture.
[7] The expenditure approach concentrates on the categories of private consumption, government consumption and capital formation.
[8] See for example Flux, 1933.

consumption, but mainly produce intermediate inputs for other industries. If I would use expenditure prices to obtain a benchmark, these sectors would be insufficiently covered. Unit values are obtained by dividing the ex-factory sales value, i.e. total turnover *(v)* by the corresponding quantity, or volume of output, *(q)* for each product i in industry j.

$$uv_{ij} = \frac{v_{ij}}{q_{ij}} \tag{2.1}$$

Products with similar characteristics can be matched, and the ratio of the unit values is taken as the relative price of the specific matched product. Thus, the unit value ratio (UVR) of the two countries represents the relative producer price of each matched product, in terms of country B's currency per unit of A's currency.

$$UVR_i^{BA} = \frac{uv_i^B}{uv_i^A} \tag{2.2}$$

A comparison of unit values provides the basis of the industry-of-origin purchasing power parities (industry PPPs), which I use to compare the value of output per head and per hour worked in West Germany and Britain both in 1935 and in 1951.[9] By aggregating UVRs, I can derive a conversion factor for gross output and value added in a given industry. Because only part of the products produced in an industry are matched the UVRs are weighted several times to obtain a reliable total manufacturing PPP. In the construction of an industry PPP, UVRs are weighted according to their share in gross output. The resulting industry PPPs are then aggregated using the weights of their share in manufacturing gross output to obtain a conversion factor for larger industry groups. Finally these PPPs are weighted according to their branch shares in total manufacturing in order to obtain a PPP for the aggregate manufacturing industry.[10] Instead of using gross output to determine the weights of industries it is possible to use value added in weighting the importance of sub-branches in an industry. I will use both approaches. In the following formula, *(i)* represents the matched product in

[9] The name PPP can be slightly misleading, since the actual term is not a real purchasing power parity. It is the weighted average of unit value ratios, which are relative producer prices. However, the term PPP has been used in the existing literature on industry-of-origin benchmarks and will thus be used here as well.

[10] In this work I focus mainly on value added comparisons, I do show the results obtained when gross output is used to weight industries.

industry *(j)*, whereas (w_{ij}) is the share of product *(i)* in the gross output of industry *(j)*.

$$GOPPP_j^{BA} = \sum_{i=1}^{I_{j,GO}} w_{ij}^{A(B)} UVR_{ij}^{BA} \qquad \textbf{[2.3]}$$

There are alternative techniques to weight individual industries within industry groups and the latter within total manufacturing. By using the weights of the base country A, I obtain the Laspeyres gross-output PPP.

$$GOPPP^{BA(A)} = \sum_{i=1}^{I_{j,GO}} w_{ij}^{A(A)} UVR_{ij}^{BA} \qquad \textbf{[2.4]}$$

Where $w_{ij}^{A(A)}$ is the output weight of product i in base country prices and quantities. By contrast, the Paasche PPP is obtained when using the weights of the other country B.

$$GOPPP^{BA(B)} = \sum_{i=1}^{I_{j,GO}} w_{ij}^{A(B)} UVR_{ij}^{BA} \qquad \textbf{[2.5]}$$

Where $w_{ij}^{A(B)}$ is the quantity weight of the other country valued at base country prices.In general, it is expected that the Laspeyres PPPs are higher than Paasche PPPs because of the negative correlation between prices and quantities of products on the same market. The quantity weights of the other country B are, therefore, relatively large. The Laspeyres PPP [4] is constructed by using the weights of the base country A, hence, the valuation of gross output at foreign quantities will tend to inflate its aggregate value. This is known as the 'Gerschenkron effect', named after Alexander Gerschenkron who described this effect in detail in 1955. The conversion factor which can be used in constructing a labour-productivity comparison is most commonly obtained by taking the geometric average of the Paasche and Laspeyres PPPs, known as the Fisher PPP.

$$F^{GOPPP} = \sqrt{\sum_{i=1}^{I_{j,GO}} w_{ij}{}^{A(A)} UVR_{ij}^{BA} * \sum_{i=1}^{I_{j,GO}} w_{ij}{}^{A(B)} UVR_{ij}^{BA}} \qquad \textbf{[2.6]}$$

The Fisher index has several favourable properties over the above alternatives. The most important for my study is that it satisfies the country reversal test, thus changing the denominator and numerator does not alter the results (Van Ark 1990, p.30). Moreover, a Fisher price index times a Fisher quantity index gives the Fisher value index. When the price indexes are extrapolated, the Fisher index shows a smaller margin of error from the true year of extrapolation than the Paasche and Laspeyres index (Krijnse Locker and Faeber 1984).

Output-based productivity comparisons are subject to distortions caused by differences in product quality, as UVRs are computed on the basis of sheer quantities.[11] Quality differences are especially important in consumer durables and investment goods and somewhat less import in intermediates such as steel, cement, paper, and timber (Van Ark 1993). Another important advantage of the price approach is that, as Van Ark (1993) argues, there is a general consensus in the literature that the representativity of measured prices for unmeasured prices is better that that of measured quantities for unmeasured quantities. The underlying idea is that products which are closely related in terms of either inputs or the used production technique are likely to exhibit similar movements in prices (Van Ark 1993).

In the existing literature, most labour-productivity benchmarks have been constructed on the basis of measuring labour input by employment. However, due to significant differences in the length of the working week and the number of vacation days, real hours worked in a man-year vary substantially between countries. Therefore, a comparison based on man-hours is preferred whenever reliable data on labour hours are available. In this investigation, I report benchmarks both based on man-year and man-hour worked, since this will show the importance of the distinction. In my analysis I will focus mainly on the latter.

2.2.3 The year of comparison

Ideally one would prefer a labour-productivity comparison after the Second World War at the beginning of the high growth period which is known as the Golden Age of economic growth. Both West Germany and Britain have production statistics available for the end of the 1940s. However, a productivity comparison is only relevant if the rate of unemployment and capacity utilisation in the two countries is relatively similar (Rostas 1948).

In 1948/9 Germany's economic climate was marked by deflationary pressure, and the average monthly decrease of the price level was around half a per cent in 1949, and even as large as one per cent in the first months of 1950 (Giersch, Paqué

[11] However, it has been argued by Broadberry and Fremdling (1990, p. 408) that in the early post-war period, this problem was not as severe as it is today. Broadberry and Crafts (1990, pp. 376-377) demonstrated that the productivity performance of Britain relative to the United States in 1948 appears to have been remarkably similar whether the comparison is based on net output converted by relative unit value ratios or on a physical-output benchmark, as in Frankel (1955).

and Schmieding 1992, p. 46). This was partly the result of the business cycle, and partly the result of the tightening of liquidity by the Bank deutscher Länder.[12] The United Kingdom also faced problems related to the war. Most notably was the existence of a rationing system. Due to the high dependency on imported foodstuffs and the attempts of the Germans to hinder the inflow of goods into Britain during the war, a system of rationing had to be installed.[13] On 8 September 1939 the Ministry of Food, which was to be responsible for the allowance of food, was formally established in Britain (Alcock 2008; Chalmin 1990). From 1940 onwards food and other consumer goods became subject to rationing or distribution schemes (Zweiniger-Bargielowska 1994; 2000). Rationing of food was not done by means of price control, but by means of distribution (Alcock 2008).[14] After the war the rationing was not ceased, furniture remained rationed until the end of 1948, and the rationing of clothes came only to an end in March 1949 (Zweiniger-Bargielowska 1994). More important for industrial output was probably the raw material allocation, of which the most relevant were coal, steel and timber (Cairncross 1985, p. 336).[15] Therefore, the pre-1950 period is not suitable for a comparison, many prices were not signalling equilibria.

For both the United Kingdom and West Germany detailed data on production is available for 1951. The United Kingdom was experiencing low unemployment, between 1 and 1.6 per cent in the first half of the 1950s. Germany's unemployment rate was close to ten per cent at the beginning of the 50s.[16] However, Germany's high unemployment is partly the result of the large inflow of refugees and thus not an indication of failing labour market institutions or cyclical factors. By 1951 most of the controls and rationing schemes also came to an end

[12] The Bank deutscher Länder was founded on March 1 1948 and was a predecessor of the Deutsche Bundesbank. The main task was to manage the currency policy.
[13] Immediately before the Second World War, two-thirds of the calory intake of Britain originated from imported foods (Olson, 1963, p. 117).
[14] The Ministry used the term allowance instead of rationing.
[15] Aluminium, wool and rubber ceased to be allocated in 1947, tin cotton and most hardwoods in 1949.
[16] Calculated on the basis of Feinstein1972, p. 126 and Eichengreen and Ritschl, 2009, p. 213.

(Cairncross 1985). Therefore, productivity levels in 1951 for West Germany and the United Kingdom can safely be compared.[17]

2.2.4 Double deflation

Although most existing benchmark studies rely on single deflation, another method exists to obtain benchmarks: the so-called ‘double deflation’ method. Paige and Bombach (1959) were the first to apply the concept of double deflation, although they called it the ‘double indicator method’.

Fremdling et al. (2007) provide a thorough discussion on the advantage of applying the double deflation method. According to them the theoretically correct way to obtain a benchmark would be to use data on gross output and intermediate inputs in both countries, and convert them to a common currency using two PPPs, one for output and one for intermediate inputs. The results of using single deflation are especially biased when there are large differences in the technical input-output coefficients of an industry between two countries. That is, when the two countries use a different production technique, different types of materials, or they use different amounts of imported materials. Moreover, when relative prices of output and input differ across countries, single deflation might also lead to misleading results (Fremdling et al. 2007).[18]

The double deflation method has been mainly applied in studies on productivity in agriculture, since in this sector the input structure is relatively simple.[19] However, recently some studies have been published that use this methodology for a manufacturing comparison (Fremdling et al. 2007; De Jong & Woltjer 2011). When relying on quantity data or average value added data there is a risk that quality variations identified in the output comparison will be ignored in

[17] One potential problem in using the administered prices for coal is that in Britain the price was still fixed in 1951. This implies that the prices recorded for products produced in do not necessarily signal true equilibrium prices. However, the crucial question is to what extent my productivity estimation would be different is the distortion would not appear. If we hypothetically assume that prices in country A are controlled, and as a result lower than what the free market would dictate, the result will be that labour productivity in country A is undervalued in comparison to country B, since simply less value added is produced in country A as compared to country B. It is difficult however, to estimate the exact size of the distortion. The problem is that in terms of labour productivity the British case in undervalued, but when we evaluate the effect of the productivity of a certain sector on the total economy, we should take into account the actual prices for which products were sold. For the total contribution of individual industries to British relative economic decline we should take into account actual prices. However, we should be careful to conclude that a relatively poor British performance is the result of malfunctioning in the production process or failure.

[18] Fremdling et al. (2007a, pp.360-361) provide a very simple and clear numerical example to illustrate the effect of applying double deflation.

[19] See e.g. Van der Meer and Yamada 1990; Maddison and Van Oostroom 1993.

the input comparison and the other way around. A country might be credited with a net output that is too high in a particular industry because its higher quality output was the result from better quality materials, but that was not reflected in the measure of material inputs. For example, when a price comparison for the clothing industry takes account of all quality differences, but inputs of fabrics can only be deducted in rather crude quantity terms, this problem can occur. In most cases the census will provide information on either weight units or the number of products, but not on both. Thus, these problems cannot be circumvented.

Van Ark (1993, p.41) spelled out some methodological objections against the double deflation method. Firstly, the Paasche and Laspeyres unit value ratios can differ substantially when the share of intermediate inputs in gross output differs between the countries under comparison. Secondly, relatively small measurement errors in the price ratios of outputs or inputs tend to become magnified in the unit value ratio when intermediate inputs make up a large part of output.

Since there is a lack of reliable data on intermediate inputs in the German and British census in many sub-industries, and given the problems in applying double deflation in a consistent manner combined with the statistical problems which arise when using the double deflation technique, I will rely on single deflation throughout this work. This means that I implicitly assume that the relationship between the average costs of inputs in the two countries under comparison is identical with the output price index. However, this does not mean I assume identical technical input-output factor coefficients for similar industries in the two countries; this would manifest itself in similar value added to gross output ratios and I find that in most cases this ratio is not exactly the same for two similar industries. Variations can occur as a result of a difference in production method, different types of intermediary goods used, the amount of imported materials, or due to a difference in the industry classification between the two countries (Fremdling et al. 2007). The correlation between the ratio of value added over gross output between the United Kingdom and West Germany is 87.35 per cent, and statistically significant even at the one per cent level. Hence, there is ample reason to believe that there is no substantial difference in the technical input-output structure in the two economies.

2.3 Constructing a benchmark for 1951

2.3.1 Data on output, value added and employment for 1951

The data necessary for the construction of the labour-productivity benchmark for 1951 have been drawn from official production data. For the United Kingdom, detailed figures on both output and labour input are presented in *The Report on the Census of Production for 1951*, published by the Board of Trade (1954). For West Germany, I derived my data from two different series in the annual industry statistics published by the Statistisches Bundesamt (1956b; 1956c).[20]

The British industry classification system lists 24 main industry groups, which are subdivided into 148 industries. The West-German nomenclature is based on five core industry groups broken down into 44 industries, which are split up into sub-branches in some cases. I harmonised these classifications and I was able to cover 24 main industries, which cover most of, although not the entire, industrial sector. I also classified the industries in 12 main industries, since this facilitates comparisons with other labour-productivity benchmarks which usually stick to a higher level of aggregation. Table A-1.1 in the Appendix provides a detailed account of my reclassification work. Since the British census reported data at a much more disaggregated level than West Germany, I followed the West-German nomenclature as much as possible. Following the classification system used in German industrial statistics is not only a choice of convenience. The German system closely resembles the United Nations International Standard Industrial Classification (ISIC), which has been widely used in the literature. Even more importantly, it is the most appropriate classification to apply when constructing industry-of-origin benchmarks. To accept the matched products within an industry to be a representative sample, we need to assume that the sub-branches within the particular industry operate with a similar production function. The British industry classification groups industry branches together which use the same type of input materials but at different levels of processing. This is extremely problematic for the above assumption because industries producing intermediary products, such as iron and steel or timber, are typically capital intensive, whereas the engineering branches, or light manufacturing substitute skilled labour for capital, and thus achieve significantly lower levels of labour productivity. By contrast, the German nomenclature groups industries into one class which operates at the same level of the vertical production chain.

[20] *Industrie der Bundesrepublik Deutschland*, Reihe 4, Die Industrielle Produktion 1950/55 (1956b). *Industrie der Bundesrepublik Deutschland*, Reihe 4: Sonderveröffentlichungen, No. 12. (1956c).

In some industries, and in particular in the smaller establishments, it might be expected that family workers play an important role. However, since both the British and West-German sources provide only information on large industrial establishments -establishments with ten or more employees- the problem of uncounted family workers will be relatively small.

In the British census of production both data on gross output and value added are presented. The German source provides only information on gross output for 1951. Value added for 1950 is available in a separate publication though (Statistisches Bundesamt 1956d). I used the value added/gross output ratio of 1950 to calculate what value added in 1951 would have been. This means that I implicitly assume that the technical input output coefficients were the same in these two years.[21]

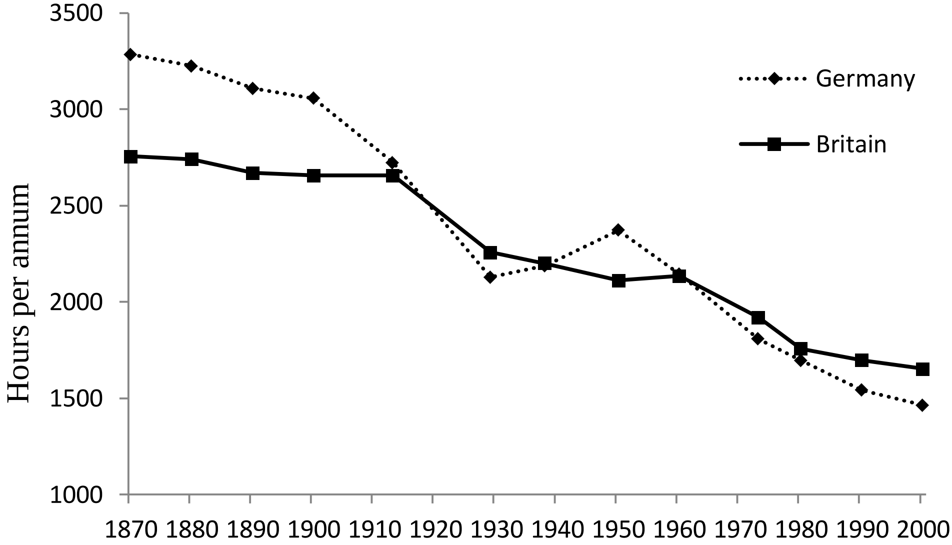
2.3.2 Hours versus working years

All previous benchmarks comparing British and German industrial labour productivity in the mid twentieth century have been constructed on the basis of raw employment data. In order to provide an appropriate measure of labour productivity, employment levels need to be adjusted for differences in the average working hours. The length of the workweek and vacation varied significantly between countries. O'Mahony (1999) has constructed estimates of annual hours worked by all engaged personnel for several countries at a disaggregated industry level.[22] Table A-1.2 in the Appendix provides data on the annual hours of work and number of vacation/holiday days per worker. The West-German workweek was considerably longer than the workweek in Britain. Figure 2.1 below shows the average annual hours worked in the manufacturing sector of Germany and Britain for the period 1870 to 2000.

[21] This assumption would be problematic if the gap between the years would be larger, or when there are notable technological developments in the period under consideration.

[22] The industry classification in O'Mahony, Table C, p. 102. reflects a higher level of aggregation than my benchmark. However, I could match my 24 industries to 18 industry groups reported by O'Mahony. I assumed that standard working hours were uniform across sub-industries. O'Mahony based her estimates of hours worked per week for Britain on data available in 'British Labour Statistics: Historical Abstract, 1886-1968' and 'British Labour Statistics, Year Book'. Data on average weeks worked per year were taken from Oulton and O'Mahony 1994. For Germany she relied on an unpublished series from the Deutsches Institut für Wirtschaftsforschung. Weeks worked per year is calculated by taking into account paid holidays, public holidays and days lost due to sickness, maternity leave and strikes.

Figure 2.1: Annual hours worked in Germany and Britain (1870-2000)



Source: Huberman and Minns (2007), Table 3, p. 548.

During the late nineteenth century and the first decade of the twentieth century, employees in Germany worked significantly more hours per year than their British counterparts. Before the Second World War the German workweek was shorter than the British workweek. In 1948 the workweek was on average 42 hours in Germany, but after repair investments it returned to the normal level of 48.2 hours a week in 1950 (Giersch, Paqué and Schmieding 1992, p. 46-47).[23] Part of the longer working hours in West Germany is explained by the fact that West Germany had very high ‘extra hours’ in the beginning of the 1950s. Schudlich (1987, pp. 158-167) reports that these additional hours worked were more than two hours per week per person. Thus there was a substantial deviation between British and West-German manufacturing in this regard in the early 1950s. This yields substantially different estimates for relative productivity levels depending on which definition of labour input is used. If we fail to take into account this difference we will underestimate Britain’s productivity level relative to West Germany. Besides the fact that the hours worked differed between West Germany and Britain, there are also pronounced differences in the annual hours worked between industries within these countries. Hence, without correcting for the annual

[23] Due to repair investments and recovery, a good part of the capital stock which had been damaged, but not destroyed, could be used again, and thus allowed for longer working hours.

hours worked it would be difficult to directly compare the productivity level between industries.

2.3.3 The matching of products

To construct my labour-productivity benchmark, I matched in total 186 products or product groups. Some problems emerged in the matching of products. Commodities under the same label are often not homogenous while similar products are frequently attributed different names in the production statistics of the two countries. Furthermore, the West-German and British data sources did not use the same units of measurement. Therefore, the British data had to be converted into metric units. In certain cases, the matching of products was not possible as the units of measurement were incomparable. Whereas German industry statistics almost always specify the volume of production in tons, the British census often reports the number of products instead. Without reliable data on average product weights in the respective industries, it is impossible to convert volume into quantities, or vice versa. This problem was particularly severe in the engineering sector, where product groups often included several heterogeneous products measured in incomparable units. For example in refrigerator production it will be very difficult to decide on the average weight of a refrigerator, since there are many different types and sizes. To solve this problem, I draw information from the British trade statistics (Board of Trade 1951), where trade volumes are specified in tons. This procedure is described in more detail in Table A-1.3 in the Appendix.

Another problem is that certain products were only manufactured in one country and, therefore, could not be matched. Data on production was not reported for reasons of confidentiality in the German industry statistics in industries that incorporated a very small number of firms. In quite a few instances there was only information on either quantity or value and not on both in the German production statistics; hence, it was impossible to match these products. Finally, in the food, beverages and tobacco industry, the German production statistics do not provide disaggregate information for the year 1951. Therefore, I calculated the unit values for food products based on the 1953 production statistics and extrapolated back to 1951, using an index of export prices calculated from the foreign trade statistics (Statistisches Bundesamt 1953, pp. 311-314; 1956a, p.4). For timber and musical instruments I only had information on production in 1952 and I used the same procedure as for food.

I omitted two industries from my benchmark, where a labour-productivity comparison between the two countries in the early 1950s would not have made practical sense. Aircraft manufacturing was shut down in West Germany after World War II, in accordance with the Potsdam Agreement, and was only re-established after 1955, when the Federal Republic had joined NATO. In 1951, only 188 employees were engaged in the aircraft industry, carrying out repairs on existing civilian airplanes (Gareau 1961, p. 522; Statistisches Bundesamt 1956d).[24] The building of sea-going vessels was also severely restricted until the lifting of the occupation statutes in 1951, and the product composition in shipbuilding was also markedly different than it had been before the war, or from what it was in the United Kingdom (Gareau 1961, p. 522).

The final challenge was that the widespread price controls that remained in place all over Europe until the early 1950s could affect input and output prices very differently in the two countries. Certain food products were still rationed in 1951. For example the controls over distribution, use, and price of sugar in Britain was only removed in September 1953.[25] Sugar, syrup and molasses are important inputs into other foodstuff industries, such as the chocolate and sweets industries, jams and preservatives, cake and flour confectionary, biscuits, and soft drinks. The jam and preservatives industry in the United Kingdom was already meeting consumer demand for some time, hence, the abolition of the rationing should not have affected this industry, but for the chocolate industry it was expected that there would still be a rise in production.[26] Unfortunately I could not solve this problem completely, since I do not know the prevailing prices if the rationing system would not be operating. But given that some of these food industries were already meeting consumer demand, I assume that the impact was not too big. However, caution must be taken in interpreting the results of the estimates for these particular industries.

Price movements caused sharp deviations in the ratio of value added to gross output between West Germany and Britain in two branches of light manufacturing, textiles and leather, leading to unrealistic productivity estimates. To overcome this problem, I had to assume that the value added to gross output ratio in textiles and the leather industry remained constant between 1935 and 1951 in both countries.

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[24] In comparison, in 1936 almost 48000 people were employed in this industry (electronic database of Sleifer 2003).

[25] Foreign news in the Journal of Agricultural and Food Chemistry, vol. 1, no. 15, 1953, p. 919. Britain was highly dependent on sugar imports and at the same time exports from the Commonwealth member countries decreased and exports from South Africa also came to a standstill due to the growing domestic demand in Africa. Britain became dependent on imports from Cuba and Santo Domingo (the dollar zone) but she did not possess enough foreign currency to meet the purchase quota of Cuban sugar. Hence, sugar remained under control (Chalmin 1990, pp. 228-232).

[26] Information drawn from Foreign news in the Journal of Agricultural and Food Chemistry, vol. 1, no. 15, 1953, p. 919.

Table A-1.3 in the Appendix provides more detail on the adjustments I made.

Despite the difficulties in the matching of similar products in West Germany and the United Kingdom I was able to match a substantial amount of products, Table A-1.4 in the Appendix presents the list of matched products, the corresponding values and the unit value ratios.

2.4 Labour-productivity estimates for 1951

2.4.1 Purchasing Power Parities

Table A-2.5 in the Appendix presents the number of matched products, the coverage ratios and the Fisher PPPs for the 12-industry classification, the 24-industry classification and for industry as a whole. The 186 matched products or product groups cover 26 per cent of British industry and 33 per cent of German industry. The coverage ratio varies considerably across industries, which reflects the above mentioned difficulties in the matching of products. However, having a low number of product matches does not necessarily lead to unreliable results. In certain industries one product can cover a very substantial part of total output. In coal mining for example the coverage ratio is very high, even though there is only one matched product. Implicitly I assume in my methodology that the price ratio for the non-covered items will be similar to the price ratio of the matched products.[27] When products are produced with similar production functions, or similar inputs, I can expect that they exhibit similar price movements.

The Fisher PPP for total manufacturing is 11.88, which is actually close to the official exchange rate, which was 11.67 Deutschmark (DM) to the pound in 1951. However, for several industries, the industry-specific PPP deviates strongly from the exchange rate. Such discrepancies occur because the exchange rate fails to take account of the fact that the purchasing power of a currency will normally differ between different products. This problem was particularly severe in the early 1950s, still marked with quantity controls and other trade restrictions under a fixed exchange rate regime.

[27] This assumption will be more problematic when comparing two countries in a different state of development (Van Ark 1993). In general it can be expected that it is easier to match products with low quality content, since these are more homogenous. When the countries are in a different state of development, it might be expected that the less developed country produces less high quality products, which will be relatively higher priced.

2.4.2 Labour-productivity estimates

I used the PPPs reported in Table A-1.5 in the Appendix, to convert gross output and value added per employee and per man-hour worked in West-German industry from DM to Pound Sterling. Table 2.1 below reports my estimates for labour productivity in West Germany relative to the corresponding British levels for 24 industrial branches, Table A-1.6 in the Appendix provides the resulting labour productivity levels when I use the more aggregated 12-industry classification.[28] Table 2.1 presents the estimates for total manufacturing and total industry, where the latter consists of total manufacturing and coal mining. In the remainder of this dissertation I will focus mainly on the total industry estimate.

In terms of gross output per employee, West Germany was lagging almost sixteen per cent behind the United Kingdom at the aggregate level. In gross output per hour, we see that West Germany is performing even worse, 25 per cent below the British level. Hence, the difference in working hours has a substantial effect. We indeed undervalue the British performance if we do not take working hours into account. Only in coal mining Britain reported a larger amount of hours worked per annum than Germany.[29] There is a substantial difference between the gap in gross output per hour, and the gap in value added per hour for certain industries. This is the result of a different value added over gross output ratio in West Germany and the United Kingdom. In value added per man-hour worked, the German performance was somewhat better at 84 per cent of the British level. However, large difference across industries can be observed. In the remainder of this section, I discuss the estimates for value added per hour worked.

[29] Caution has to be taken in interpreting the results when taking hours of work into account in coal mining, since it might be that there is a difference in the way hours worked are reported in West Germany and in Britain. This difference can occur depending on whether the time a miner arrives at work is seen as the start of the working day, or whether the time the actual mining work in the pit starts is counted.

Table 2.1: Comparative labour productivity in manufacturing in the UK and West Germany 1951 (UK=100)

	Per worker		Per hour	
	Gross output	Value added	Gross output	Value added
Textiles	90	114	83	105
Leather	75	103	66	91
Footwear	93	108	83	96
Clothing	97	95	86	84
Iron and Steel	99	136	89	122
Non Ferrous Metals	63	92	57	83
Fabricated Metal Products	82	51	72	45
Vehicles	82	106	74	96
Mechanical Engineering	90	109	79	95
Electrical Engineering	84	89	76	81
Optical and Precision Engineering	90	115	78	99
Tobacco	19	18	16	15
Beverages	54	62	44	51
Food Products	126	192	104	158
Chemicals	98	120	85	104
Glass	122	136	107	119
Building Materials	60	76	53	67
China and Earthenware	84	90	74	79
Woodworking	74	100	63	86
Timber	129	144	110	122
Paper and Board	100	138	87	120
Rubber and Asbestos	54	87	50	80
Miscellaneous	52	84	46	73
Total Manufacturing	**84**	**94**	**75**	**83**
Coal Mining	82	81	89	88
Total Industry	**84**	**93**	**75**	**84**

Sources: own calculations, see text for the underlying sources.

British firms achieved higher levels of labour productivity than their West-German counterparts did in the majority of industries, but their lead was especially striking in fabricated metal products, building materials, beverages and tobacco manufactures. West Germany was lagging behind most in the tobacco industry, where its productivity was less than one-sixth of the British level. This massive gap reflects the fact that the industry is composed of two sub-branches: the manufacturing of cigarettes is highly capital intensive and thus features high levels of labour productivity, whereas the production of cigars relies heavily on manual labour and, thus, generates considerably less output per worker. Table 2.2 shows the production volume of cigars and cigarettes in both the United Kingdom and West Germany.

Table 2.2: Production of cigarettes and cigars in the UK and West Germany 1951

	Production UK (millions)	Value 1000 £	Production GE (millions)[a]	Value 1000 DM
Cigarettes	112296	652622	36295	880066
Cigars	102	3408	4388	417854

a) The production and value refer to 1953, since no information is available in the production statistics for 1951.

Sources: Statistisches Bundesamt (1956d), '*Die Industrielle Produktion'*, sonderheft 11, p. 73. Board of Trade (1954), '*The report of the census of production for 1951*', p. 9/N/5.

Whereas cigarettes represented the overwhelmingly dominant component in Britain, cigars still had a large share in the German tobacco industry in the early 1950s. West Germany was producing 43 times as many cigars as Britain, whereas it was producing only one third of the amount of cigarettes Britain produced. In Germany cigars have always been more popular than in Britain, cigars were smoked by a wide variety of people, ranging from lower to upper class (Prais 1981, p.99). Prais (1981) estimated that in Germany as much as three-quarters of the employment in the tobacco industry was involved in cigar making in 1950. Unfortunately I do not have separate employment information for the cigarettes and cigar branch in Britain, which prohibits me to split the industry into two sub-branches. It is important to realise the difference in the nature of the two tobacco industries, which explains the difference in productivity performance. However, we do have to take the performance of this industry into account, since it plays a role in the total manufacturing gap. Britain is not extremely productive, nor is West Germany failing in productivity. Instead, I conclude that the Germans had a bigger taste for a different product, which was less efficient, in terms of labour-productivity, to produce. Broadberry (1997) found a similar taste difference in the biscuits industry. Britain's labour-productivity level is less than a third of the US labour-productivity level in the late 1960s. Part of this massive difference in productivity levels can be explained by the bigger taste of the British for a large variety of products. In the United States production was standardised, which led to higher efficiency. In the next chapter, I will apply shift-share analyses and decomposition techniques to evaluate to what extent individual industries contributed to the aggregate productivity gap.

Thanks to a long-established superiority in steel making and the major steel-processing industries, West Germany retained its productivity lead in iron and steel, and stayed very close to British productivity levels in the engineering sector; with the exception of electrical engineering. In the chemical industry, West Germany also preserved a small productivity lead. It is interesting to see that West-German manufacturers also outperformed their British rivals in the textiles, glass, timber and paper industries, where they had never been particularly competitive. Under the Nazi war economy, light manufacturing was deprived of labour, which pushed up the capital-labour ratio and urged firms operating in these industries to economise on labour. This forced wartime rationalisation combined with the post-currency reform consumer boom that emerged in the second half of 1948 placed these industries into a favourable position in terms of labour productivity. In the food industry, the large German productivity advantage contrasts a similar British lead in beverages. Both are to a large extent the outcome of discrepancies in product composition, meaning that sub-branches with different levels of labour productivity had very different weights in the two countries. In West Germany the grain and dairy industry accounted for a larger percentage of output in the food industry than in Britain. In Britain preserved meat and bread making were substantially more important than in West Germany.

As mentioned earlier there are alternative estimates in the existing literature for comparative labour-productivity levels of West Germany and the United Kingdom in manufacturing and in the economy as a whole for 1950. Table 2.3 below summarises the results. As I have explained in the Introduction, all previous estimates were derived by extrapolation from distant benchmark years. Each of these benchmarks is sufficiently far away in time for the time-series projections to generate biased estimates for the early 1950s. Relative prices may change over time and thereby render distant industry PPPs obsolete. To be able to compare my new 1951 labour-productivity estimate with the existing 1950 estimates I have extrapolated my estimate backwards to 1950. This step is important because there was a substantial difference between the rate of productivity growth in British and West-German industry from 1950 to 1951. I used time-series evidence to project backward from 1951 to 1950. This makes my estimate directly comparable with the other estimates.[30]

Table 2.3: Alternative estimates of labour-productivity in the UK and West Germany in 1950 (UK = 100)

	Manu-facturing	Total economy	Description	Data source
Van Ark (1990)	74	-	Comparison Germany/UK on the basis of market prices instead of factor costs. Gross value added per person hour.	Extrapolated from the 1967/1968 benchmark of Smith, Hitchens and Davies (1982).
Van Ark (1993)	89	-	Value added per hour worked.	Based on an extrapolation of 1987 benchmark.
O' Mahony (1999)	74	72	Value added per hour worked. The total economy estimate is based on output per hour worked.	Extrapolation of output per employee of 1987 benchmark (O'Mahony 1992).
Broadberry (1998)	96	72	Gross output per person employed.	Extrapolation of 1935 benchmark of Broadberry and Fremdling (1990).
My new benchmark	79	-	Value added per hour worked derived from 1951 production censuses and labour statistics.	See text.

Sources: Broadberry (1998), p. 382; O'Mahony (1999), p.16; Van Ark (1990), p. 345, Van Ark (1993), p. 90.

The aggregate manufacturing productivity gap I report can be explained in two ways. First, Germany always demonstrated higher productivity relative to other advanced nations, and particularly the United Kingdom, in manufacturing than in agriculture or services. Data from the Conference Board on GDP per capita and GDP per man-hour worked indicate that the West-German economy was one-third less productive than the British in 1951.[31] My benchmark indicates a notably smaller gap in manufacturing, but one large enough to support the above pattern for the economy as a whole. Second, my estimates are directly derived from

[30] Data is drawn from: Statistisches Bundesamt, Lange Reihen, pp. 74-75; Statistisches Bundesamt (1975), p. 7; Central Statistical Office (1958); Department of Employment and Productivity (1971) Tables 25-26, and Table 138.

[31] Based on data from the Conference Board, http://www.conferenceboard.org/data/economy-database.

current-price data on industrial production in 1951, and thus are unaffected by distortions that arise from changing relative prices in time-series extrapolations.

It stands out that my benchmark is closer to the estimates derived by backward projection from recent benchmarks. There is a substantially bigger gap between my estimate and that of Broadberry, which was constructed by forward projection from a 1935 benchmark and which measures gross output per person employed. Using the same specification, my benchmark for 1951 is 84, which is almost ten per cent below the level Broadberry has estimates for one year earlier. This finding suggests that changes in relative prices and the shifting weights of different industries were much more significant across the 1940s than during the post-war Golden Age that has been characterised by unprecedented macroeconomic stability. My estimate is also significantly different from the estimate of Van Ark, based on the 1967/1968 benchmark. This can be explained by the fact that he used market prices. As explained before, this is usually not a reliable converter.

2.5 The revision of labour-productivity estimates for 1935

Fremdling et al. (2007a) constructed an industry-of-origin benchmark for value added per worker in British and German manufacturing for the mid-1930s. They used the 1935 UK industry census and the archival records of the census of German industry, which was carried out in 1936 and published in 1939 by the Imperial Office of Economic Planning for Warfare.[32] Albeit certainly the most meticulously constructed study on the subject to date, the estimates Fremdling and associates provide are inappropriate for my investigation for three reasons. One, they cover the German Reich within its interwar territory, and thus it cannot be directly compared with my 1951 benchmark. Second, the industry classification does not match the post-war German nomenclature that I have used. Third, the 1935 benchmark was not adjusted for differences in hours worked between the two countries.[33]

In a comparative study of East and West-German labour productivity, Sleifer (1999) computed values for gross output, value added, employment, and labour productivity for all industries reported in the 1936 German industry census according to post-war borders. Sleifer has kindly granted me access to his data set.

[32] Although this labour-productivity estimate is a 1935/1936 estimate I will refer to it 1935 in this text.

[33] In their Appendix Fremdling et al. made an estimate of the potential bias in measured productivity levels, where they concluded that the nr. of hours worked in the United Kingdom was 47 hours, versus 45 hours in Germany, which means that the labour productivity in the United Kingdom is overstated by roughly 4 per cent in their estimate for total manufacturing.

I was able to use the product matches of Fremdling et al. and the specific West-German data on gross output, value added and employment from the Sleifer data set. This allowed me to calculate new industry PPPs, using the same method as for the 1951 estimates, and to generate a new labour-productivity benchmark for West Germany and Britain. Since the product matches are derived from the census that covered the whole of Germany, I had to assume that the average value of similar products in East and West Germany did not differ.

In total I used 229 matched products from Fremdling et al. and I was able to match 57 industries. Table A-1.7 in the Appendix provides more detail on the sources used and the adjustments I made. Table A-1.8 in the Appendix provides detailed information on the classification of industries. I grouped industries together to correspond to my 1951 benchmark, which lists 24 industry branches. In the process, I have excluded the aircraft industry and shipbuilding, as they do not appear in the 1951 benchmark for reasons explained above. Table A-1.9 in the Appendix provides details on the number of matched products, the coverage ratio and the Fisher PPP for all industries included.[34] The number of industries presented in this table is substantially larger than my 24-industry classification. I choose to calculate the PPPs at the most disaggregate level possible, and I calculated the PPPs for the 24-industry classification on the basis of these underlying PPPs.

To adjust the re-estimated relative labour-productivity levels for hours worked, I use average weekly hours as reported in the *International Labour Office Yearbook* (International Labour Office 1939, p.44) and in the *British Labour Statistics* (Department of Employment and Productivity 1971, pp. 96-97, and pp. 104-107), and the statistical yearbook of the German Reich (Statistisches Bundesamt 1940, p. 384).[35] These data are differentiated by industry. I adjusted for the number of sick days and holidays; for which data are available from Huberman and Minns (2007, pp. 546-568). Since I do not have regionally disaggregated data on working hours for Germany I had to make the simplifying assumption that average annual hours per worker within individual industries did not differ across regions of the German Reich. Table A-1.10 in the Appendix presents the data on hours worked for 1935.

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[34] For a list of the products and UVRS used see Appendix 3 pp. 32-33 in the reseach memorandum of Fremdling et al. 'Censuses compared. A new benchmark for British and German manufacturing 1935/1936', Groningen Growth and Development Centre.

[35] British industry was operating on a six-day workweek. In Germany, there were some variations, so I adjusted for daily hours from Wirtschaft und Statistik 1938, vol. 18, 5, p.187.

2.5.1 Labour-productivity estimates for 1935

My revised labour-productivity estimates for the 24-industry classification is reported in Table 2.4. Table A-1.11 in the Appendix provides the estimates for the 12-industry classification. In the mid-1930s West Germany had an eleven per cent lead over Britain in terms of value added per hour worked in manufacturing. For total industry the lead was even higher, since West Germany had a substantial lead in coal mining. The German superiority was most marked in the metallurgical industries, engineering and chemicals. As in 1951, the two industries where German manufacturers performed poorly in terms of productivity were tobacco and beverages. The German tobacco industry was dominated by cigar manufacturing which employed little capital and relied heavily on the use of labour, whereas cigarettes were already the dominant item in the product mix in the United Kingdom during the 1930s.

Table 2.4: Comparative labour productivity in manufacturing in the UK and West Germany 1935 (UK =100)

	Per worker		Per hour	
Industry	Gross output	Value added	Gross output	Value added
Textiles	85	109	97	124
Leather	58	84	64	93
Footwear	77	70	83	76
Clothing	94	102	98	106
Iron and steel	149	135	152	138
Non Ferrous Metals	126	144	129	146
Fabricated Metal Products	99	112	105	119
Vehicles	104	118	110	125
Mechanical Engineering	111	122	109	120
Electrical Engineering	121	143	127	150
Optical and Precision Engineering	91	104	96	109
Tobacco	20	18	22	20
Beverages	49	43	54	47
Food Products	98	130	106	141
Chemicals	116	111	121	116
Glass	84	94	86	96
Building Materials	76	85	78	87
China and Earthenware	113	132	123	144
Wood	128	143	135	151
Timber	163	170	172	179
Paper and Board	188	175	203	189
Rubber and Asbestos	93	103	102	113
Miscellaneous	63	77	70	84
Total Manufacturing	98	107	105	115
Coal Mining	159	119	158	119
Total industry	101	108	109	115

Sources: the adjustments to the Fremdling et al. (2007a) estimate are partly based on the electronical database of Fremdling et al, and the Sleifer (2003) electronic database. Data on hours worked is obtained from the following sources: International Labour Office (1939), '*Yearbook of labour statistics'*, p. 44; Department of Employment and Productivity (1971), '*British labour-statistics: historical abstract 1886-1968*', pp. 96-97, 104-107; Statistisches Reichsamt (1940), '*Statistisches Jahrbuch 1939/1940*', p. 384; Wirtschaft und Statistik (1938), vol. 18, 5, p.187; Huberman and Minns (2007), pp. 546-568.

When I compare my revised benchmark with the estimates of Fremdling et al., a few findings stand out. First, for most industries, I report higher levels of labour productivity. This can be explained by the higher productivity levels in West-German industry as compared with the whole German Reich. Sleifer (2006, p. 78) found that East Germany was at 88.9 per cent of the West-German productivity level in manufacturing. Since industrial valued added for West Germany makes up roughly two-thirds of German industrial output in 1936, I can expect a difference between the benchmark for West Germany and the whole of Germany. Moreover, my classification is constructed to match as precisely as possible my 1951 labour-productivity estimate. This means that I deviate in some industries from the classification of Fremdling et al., therefore, the results of my West-German estimate, and their estimates for the whole of Germany cannot directly be compared.

At the industry level, more substantial differences emerge. In textiles, Fremdling et al. estimate that the German Reich was at 96.7 per cent of the British level in terms of value added per worker. I find that West Germany was nine per cent more productive than the United Kingdom. This is partly the result of a slightly different classification of the textiles industry. Moreover, West Germany was more productive than East Germany in some textiles manufacturing industries, which also explains part of the difference.[36] Furthermore, my PPP is a bit lower than the PPP calculated by Fremdling et al. This is due to the weighting of industries which is done with either gross output or value added. The West-German weights are different from the weights for the complete German Reich. Hence, the weighting of industries in my work differs slightly form the weighting in the work of Fremdling et al.

According to my new estimates, the engineering sector reported a West-German productivity lead of 20 per cent in terms of value added per worker. Fremdling et al. report a smaller gap of 12.3 per cent. This difference can be explained by the fact that West Germany was 12.6 per cent more productive than East Germany in this sector.[37] Engineering also presents a powerful example for how important it is to disaggregate further than previous studies have done. Although I find that in the engineering sector West Germany commanded a 22 per cent lead in value added per man-hour worked over Britain, this average figure disguises substantial differences at the industry level. The gap was as large as fifty

[36] East Germany was more productive in some of the textile branches, e.g. wool washing, flax and hemp roasting, and felt, however, these were all relatively small branches.
[37] Based on the electronic database of Sleifer 2003.

per cent in electrical engineering, but only nine per cent in optical and precision instruments.

2.5.2 Time series extrapolation

The ability to compare relative productivity levels in British and West-German industry in the mid-1930s and the early 1950s based on two methodologically consistent benchmarks enables me to assess the consequences of World War II for the British-German productivity race. As argued in the Introduction, an important added value of my work is that it does not rely on time-series extrapolations, which has been a major caveat of previous studies. In fact, my two benchmarks can be used precisely to demonstrate how much distortion time-series extrapolations can introduce. Distortions can be very substantial in a period characterised by marked structural shifts between and within industry groups and equally significant changes in relative prices. Generally, direct benchmark comparisons and time-series extrapolations should arrive at similar estimates at the aggregate level where inter-temporal shifts tend to balance out. However, this only holds when comparisons are consistent, or transitive, across time (Dalgaard and Sørensen 2002).

I expect to find much larger differences for disaggregated comparisons. To test this hypothesis, I apply historical time-series data on net industrial production and employment statistics to determine relative labour-productivity levels in British and West-German industry in 1951. I derive these alternative estimates by extrapolation from my revised 1935 benchmark. Times-series on industrial value added are drawn from Feinstein (1972) for the United Kingdom and from official industry statistics for West Germany (Statistisches Bundesamt 1956c, p. 17).[38] I rely on Feinstein's estimates, which do not take into account hours worked. Therefore, I also do not adjust for working hours in this exercise. The time series constructed by Feinstein only disaggregate into seven major industry groups, I recalculated my benchmarks according to this classification and aggregated the data from the other sources up to this level. Table 2.5 reports output, employment, and productivity growth between 1936 and 1951 for both countries.

[38] Feinstein used the index of industrial production constructed by Lomax (1959).

Table 2.5: Index numbers for employment, value added and labour productivity in the UK and West Germany 1951 (1936 = 100)

	United Kingdom			West Germany		
	Y	L	Y/L	Y	L	Y/L
Mining and Quarrying	91.8	98.9	92.8	114.3	147.3	77.6
Chemicals	205.6	188.6	109.0	147.0	169.1	86.9
Metal Manufacturing	153.8	123.8	124.2	100.4	99.9	100.5
Engineering and Vehicles	184.9	170.0	108.8	146.0	141.2	103.5
Textiles, Leather & Clothing	94.8	90.6	104.6	130.2	127.2	102.4
Food, Drink and Tobacco	133.2	105.0	126.9	121.1	92.1	131.6
Other Manufacturing	140.8	114.9	122.5	118.9	113.1	105.2
Total Industry	**147.4**	**123.5**	**119.4**	**129.2**	**121.0**	**106.7**

Sources: own calculations, see text for the underlying sources.

Manufacturing value added grew much faster in Britain than in West Germany, where the impact of wartime destruction and war-induced dislocation was more extensive and more prolonged. In West Germany the labour force expanded rapidly due to the influx of refugees from the East to the West. The labour force in the Bizone area (the combination of British and American occupations) increased spectacularly with 17.7 per cent from 1936 to 1948 (Abelshauser 1975, p. 104). However, as Dumke (1990) explains, unemployment remained relatively high until the mid-1950s. A large number of refugees fled to the agrarian areas, whereas jobs were located in industrial areas.[39]

In both the United Kingdom and West Germany, the major war industries - chemicals and the engineering sector - recorded the most impressive growth rates. Metal manufacturing in West Germany could not surpass the 1936 production level until 1951, which is not surprising given the severe output targets and dismantlement policy prevailing in this industry until the late 1940s.[40] Interestingly, the mining sector expanded faster in West Germany than in Britain, which was primarily the effect of Allied efforts to boost coal extraction in the Ruhr from the early days of the occupation by expanding employment even at the cost of declining productivity (Abelshauser 1983, pp. 36-43). In the United Kingdom, despite demobilisation, employment growth remained the highest in

[39] A shortage of housing in the industrial areas prevented an efficient reallocation of the labour force, which resulted in structural unemployment. From the 17.1 million houses 3.4 have been destroyed and another 30 per cent was severely damaged (Braun, 1990)

[40] On Allied industry plans and reparations policy in West Germany, see Plumpe 1999, pp. 31-46.

heavy industry. It was much more modest in light manufacturing and the food industries, which thus reported the highest growth rates in labour productivity.

The productivity figures reported in Table 2.5 are used in the next step to estimate relative levels of labour productivity in 1951 by extrapolation from the 1935 benchmark. Table 2.6 compares the thus derived productivity gaps to the ones determined by my new post-war benchmark. As expected, the two procedures yield very similar results for total industry. A residual of -3.16 per cent is well within the margin of error. However, time-series extrapolations introduce vastly larger distortions at the disaggregate level. With the exception of metal manufacturing, I obtain double-digit percentage differences between the alternative estimates. West Germany remained much more productive relative to Britain after the war in chemicals and light manufacturing, but performed much worse than predicted by time-series projections in mining and the metal processing industries.

Table 2.6 Alternative UK/West-German labour-productivity estimates for 1951 (UK = 100)

	Extrapolation	Benchmark	Error (%)
Mining and Quarrying	100	81	-18.79
Total Industry	**96**	**93**	**-3.16**
Chemicals and Allied Products	88	120	31.78
Metal Manufacturing	104	97	-6.86
Engineering and Vehicles	115	88	-28.01
Textiles, Leather & Clothing	99	110	11.03
Food, Drink and Tobacco	67	89	21.35
Other Manufacturing	92	109	17.64

Note: The benchmark figures are based on value added per person. The classification of industries is adjusted to match the classification of the industries in the value added and employment data. Thus, e.g. textiles, leather and clothing are taken together.

Sources: own calculations, see text for the underlying sources.

Obviously, changes in relative prices between two benchmark years will imply that the position of West Germany and the United Kingdom in the two benchmarks will differ from what is implied by the extrapolation. The time-series extrapolation relies on indices of output, which measure the growth rate of the United Kingdom and West Germany in constant prices, with a fixed underlying year. The two benchmark estimates I constructed are based on current prices.

Another issue is the reliability of the time series. First, over the course of the Second World War remarkable change occurred in the nature of produced items. Hence, comparing baskets of goods over time might be difficult. Second, there can be differences in the method used in the construction of the time series for the two countries. For Britain I used the Feinstein index of industrial production. Feinstein compiled this series using different sources. He used data from the Census of Production for 1935 and 1948. He extrapolated 1935 to 1938 using an index of industrial production constructed by Lomax (1959).[41] To extrapolate to 1964 Feinstein used the official indices compiled by the Central Statistical Office. However, tying these indices together might lead to some error. The weighting of sub-industries is also not the same as the weighting in the German time series.

Another possible source of deviation can be found in the benchmarks themselves. In some industries the coverage of products is relatively low. Especially in industries that produce heterogeneous products, it is not always the case that a low coverage in terms of price information leads to a reliable estimate for the whole industry (Paige and Bombach 1959). I find the biggest deviation between the benchmark estimates and the time series extrapolation in the engineering and chemicals sectors. These are sectors that underwent considerable technological change over the course of the Second World War, and hence it might be that the time series were not sufficiently adjusted to incorporate these changes. Considering the construction of the time series industries, and considering my work to try to estimate the labour-productivity level in a consistent way before and after the war, I believe that my new 1951 benchmark makes an important addition to the currently available quantitative evidence.

[41] First, Lomax does not provide the weighting system used for the different census years. Second, Lomax has used the output of ‘principal products’ instead of the total output of an industry. Third, in allowing for the output of small firms Lomax assumes the same ratio of ‘principal products’ to total output as for the larger firms. This assumption might be very unrealistic, as small firms tend to be more specialised in general.

2.6 A labour-productivity comparison for 1968

In this section I will introduce a labour-productivity estimate for West Germany and the United Kingdom near the end of the Golden Age. Smith, Hitchens and Davies (1982) provide a West-German/UK productivity estimate. They report comparative labour productivity levels for 70 manufacturing industries for 1968.[42] There are a few caveats in this study that prohibit direct comparison of the estimates to the 1951 and 1935 estimates. The main difference between this work and that of Smith et al. (1982) is that they rely on British weights and prices in constructing their benchmark, whereas my results were obtained by using the Fisher index, which is the geometric average of the Laspeyres and Paasche index. Smith et al. argue that the difference between using the Laspeyres and Paasche index leads at the aggregate manufacturing sector only to a difference of 7 per cent in the productivity ratio. Using the UK prices and weights gives a larger productivity advantage for West Germany as compared to using German prices and weights. This is in line with the Gerschenkron effect described earlier. Although the difference might seem to be small, In sub-industries the difference might well exceed 7 per cent. This is a severe problem when sub-industries have a different product mix.

A second problem is that instead of using gross output and/or value added to weight industries, Smith et al. use employment shares. Although I expect a high correlation between employment shares and value added shares, there is no one-by-one relation between these two. For 1951 for example the clothing industry would become twice as important in the aggregate manufacturing gap when I would use employment shares instead of value added shares. The importance of tobacco and beverages, industries with high value added in relation to employment would become much smaller in the aggregate. This will have profound impact on the aggregate gap, especially when the gaps between industries deviate substantially. This implies that it will not be possible to directly compare the 1968 labour-productivity comparison with the two estimates provided in this chapter. Nonetheless, given that this is the best available source near the end of the Golden Age, I do present the result for the 12-industry classification, however, we need to be cautious in interpreting the results.

[42] The data for Britian is derived from the 1968 census, whereas for Germany information on 1967 is used. Although this estimate is a 1967-1968 estimate, I will refer to it as a 1968 estimate.

Table 2.7: Comparative labour productivity in manufacturing industries, West Germany/UK 1968

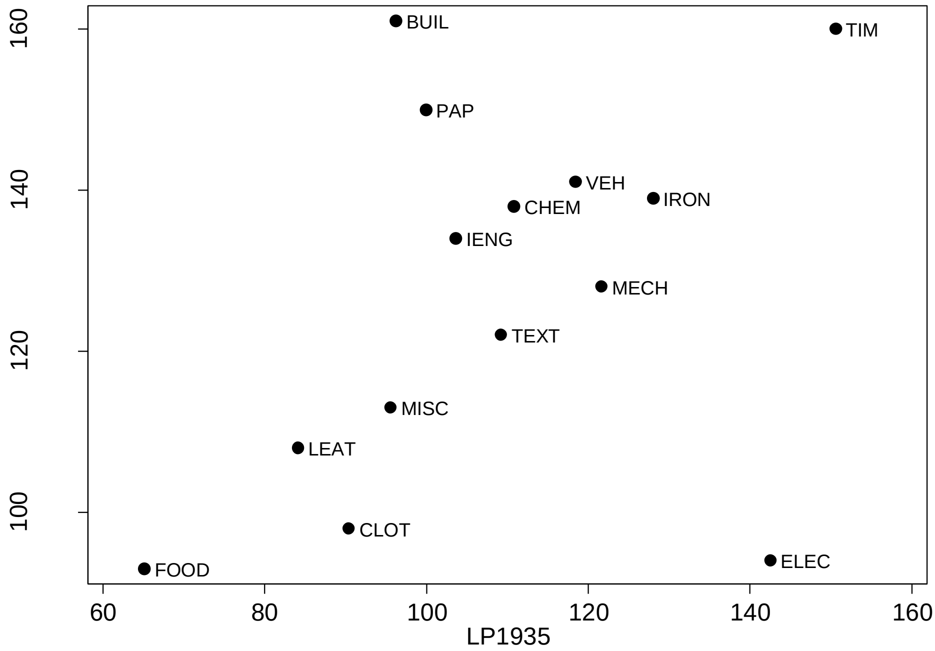
	Value added per worker		Comparative productivity UK=100
	UK (£)	Germany (£)	
Food, Drink and Tobacco	4461	4128	93
Chemicals and Allied industries	3371	4641	138
Metal Manufacture	1950	2702	139
Mechanical Engineering	2011	2581	128
Instrument Engineering	1748	1900	134
Electrical Engineering	1826	1710	94
Vehicles	1998	2808	141
Textiles	1434	1748	122
Leather	1508	1626	108
Clothing and Footwear	1087	1062	98
Building Materials	1957	3153	161
Timber	1735	2773	160
Paper and Printing	2050	3075	150
Miscellaneous	1877	2122	113
Total Manufacturing	2173	2678	123

Note: the comparative productivity is calculated on the basis of UK prices. If German prices are used the Germany/United Kingdom aggregate manufacturing gap in labour productivity is 1.15. Smith et al. do not provide a Fisher index.

Source: Smith et al. (1982), Table 10.2, pp. 122-124.

Although a direct comparison is difficult, a few findings stand out. First, at the aggregate manufacturing level West Germany is 23 per cent ahead of the United Kingdom when UK prices are used in constructing the estimate and 15 per cent ahead when German prices are used. That means that Germany indeed forged ahead during the Golden Age and managed to command a respectable lead over the United Kingdom. Secondly, the lead is especially large in chemicals, metal, vehicles, building materials, and timber. Chemicals, metals and engineering are industries in which West Germany traditionally had a comparative advantage. In the interwar period West Germany was also outperforming the United Kingdom in these industries. In 1951 West Germany had lost some ground, but by 1968 West Germany had managed to overtake the United Kingdom and regain its position as leader. West Germany outperformed Britain already before the Second World War in the timber industry. After the war this lead became smaller, but it was still respectable. By 1968 the United Kingdom was outperforming West Germany in food, drink and tobacco, electrical engineering, and clothing and footwear.

Figure 2.2: Relative levels of West-German/UK labour productivity (UK = 100)



Sources: my own labour-productivity estimates for 1935 (see Table 2.4); for 1968 estimates from Smith et al. (1982) pp. 122-124 are used.

The scatter diagram in Figure 2 plots the labour-productivity levels defined as value added per worker of West Germany relative to Britain in 1968 relative to the benchmark estimates for 1935. Obviously, we should take into account that there are methodological differences in the two estimates, but we can assume that the 1968 estimate provides a decent proxy for the labour-productivity level near the end of the Golden Age. There is a clear correlation for most industries. Electrical engineering is a clear outlier, in the sense that the performance of West Germany was much worse in 1968 as compared to 1935. If I exclude electrical engineering I obtain a coefficient of correlation of 0.687, which is significant at the 1 per cent level. Given the small sample size this is a statistically very robust finding. Whereas in 1935 West Germany commanded a respectable lead over the United Kingdom in the electrical engineering sector, this lead was lost by 1968. My estimates for 1951 already showed that West Germany lost some ground after the Second World War. But even though Britain performed very well in a comparison with Germany, in the literature the description of the performance of this industry is still negative, since the United States were outperforming Britain by a large margin. Broadberry (1997) shows that the gap is the biggest for those industries that flourish under mass production techniques, such as radios and electrical lamps.[43] Whereas the United States used these techniques intensively, the nature of British demand did not allow for this. In those industries which produced more customised goods Britain was performing somewhat better and the gap was smaller. The reason that the West-German productivity is below the British level is that West Germany was restricted by a small home market (Broadberry 1997). In the next section I will explore the relative labour-productivity developments in the engineering sector in more detail.

Another surprise might be that the food industry in West Germany is lagging behind only a bit. In the literature the food industry has traditionally been seen as a relatively well performing industry in Britain (Broadberry 1997). Broadberry concluded that over the interwar period British firms followed a successful strategy of adopting mass production techniques. Germany's demand patterns prohibited the adoption of the American mass production techniques, and hence, Britain commanded a respectable lead in the food, drink and tobacco industry. I estimated that the labour productivity level of West Germany, defined as value added per person, was at 65 per cent of the British level by 1935. For 1951 I found that West Germany improved its position, and its productivity level was at 89 per cent of the British level. The estimates of Smith et al. (1982, p.122) suggest that by 1968 West Germany's productivity was at 94 per cent of the British level.

In 1968 the United Kingdom is performing especially well, as compared with West Germany, in sugar, grain milling, and biscuits.[44] In the sugar industry Britain was already much more productive than West Germany before the war.[45] The British Tate and Lyle pursued a vertical integration strategy and became an international player in the global sugar market in the early post-war period (Broadberry 1997, p. 366). West Germany was out-competing Britain in animal and poultry foods, the dairy industry, and the vegetable, animal fats and margarine industry. The productivity advantage for West Germany in these industries was respectively 47 per cent, 82 per cent and, 21 per cent (Smith et al. p.122). Whereas both before and after the Second World War Britain had a very respectable lead in the tobacco industry, it has lost this advantage by 1968. Smith et al. (1982, p.122) report a productivity level of 1.14 in the advantage of West Germany. This is

[43] See Broadberry (1997) Table 12 and Table 15 on p. 317 and p. 335.

[44] The comparative productivity ratio of Germany over the United Kingdom is 0.49 for sugar, 0.66 for grain milling, and 0.82 for biscuits.

[45] I calculated that Germany was at 35 per cent of the British level in terms of value added per person.

mainly the result of a composition effect. The highly-labour intensive cigar sector, which was very large in West Germany, declined and cigarettes became more important (Broadberry 1997, p. 363). Hence, West Germany was able to overtake the British productivity level. At the same time however, Britain's performance in this industry was disappointing. According to Prais (1981) this was the result of the poor performance of Imperial Tobacco.

When I consider the massive gap in labour productivity in tobacco for the pre- and post-war period, I must conclude that Britain is performing relatively very well in the other food industries by 1968. In 1951 Britain was more than 5 times as productive as West Germany in the tobacco industry. Considering the relative importance of this industry in total value added this had a substantial impact on the total gap in food, drinks and tobacco.

Although West Germany almost closed the gap in the food industry near the end of the Golden Age, I can conclude that Britain did not lose ground in the productivity performance of the food industry. The food industry remained one of only a few industries in which its relative productivity level is higher than in West Germany.

The new labour-productivity estimate for 1935, 1951 and the estimate of Smith et al. for 1968 reveal some interesting developments of the labour-productivity gaps. In Chapter 3 I will discuss the potential underlying causes of these gaps in more detail. In the next section, however, I will already discuss one important industry, the engineering sector. The reason for this is that the relative labour-productivity performance of this sector might have come as a surprise.

2.7 Engineering: Germany's top performer or the shining light of British industry?

If we evaluate the productivity performance of West Germany in the engineering sector, we observe that by 1968 it was not outperforming Britain to the same extent as in some other industries, such as chemicals, or metal manufactures. At first, this may seem striking as West-German engineering firms were fiercely competitive and had been forcing their British rivals out of world markets since the early 1950s. German historiography provides ample material to unravel this paradox. In the post-war reconstruction phase, West-German engineering firms had no incentive either on the supply or on the demand side to strive for technical innovation. First, large efficiency gains could be achieved through a more efficient allocation of available factor endowments and through the elimination of stringent market regulations and state-sponsored monopolies that characterised the economy of Nazi Germany. Therefore, manufacturers had no incentive to increase their production costs by boosting their R&D expenditure and hence became less competitive in the short run. Second, after two decades of depressed consumption, the war-torn German society had an insatiable thirst for traditional manufacturing goods, particularly consumer durables. In 1950, three out of four households had coal heating and only 7 per cent of them were equipped with an electrical stove. By 1958, only every fifth family owned a refrigerator, and there was substantial pent-up demand for simple household appliances as well as furniture and textile products (Weimer 1998, p116). The life of the average working class family during the 1950s did not, in any way, mirror a matured consumer society (Wildt 1993).

Stokes (1991) argues that although some technological systems were relatively new after the war, the actual machinery was often worn out and most firms were unable to invest in new machinery as a result of Allied restrictions and limited availability of machinery. However, companies succeeded in using these older technologies and machines to capture export markets, and the proceeds from sales were gradually invested in new technologies.

The restocking of industrial plants in countries plundered under German occupation during the war meant that the engineering industries could also thrive on external markets by effectively producing at the technological level of the 1930s. In heavy equipment, firms were still exporting old coal furnaces and steam-powered locomotives.

The darling of the automobile industry remained the Volkswagen 'Beetle'. Volkswagen provides a clear example of how West-German manufactures held on to old technologies directly after the Second World War. Volkswagen's managers used existing technology and pre-war machinery to rebuild the Beetle, of which the design changed hardly from the pre-war version. Volkswagen was able to take advantage of the explosion of demand, both in Germany and abroad, during the 1950s (Turner 1985, pp. 293-299).[46] After the war Volkswagen experienced a shortage of labourers, since during the war many people from occupied nations were set to work in the factories, and they left when the war ended in 1945. After the war the refugees from the former Ostgebiete were employed (Turner 1985).

Finally, in metal products, mechanical and precision engineering, production scale was generally insufficient for standardised mass production (Radkau 1993).

[46] It must be noted that after the sales success of the early 1950s Volkswagen started to invest heavily in new plant and technical improvement, which did not lead to rises in the price of the cars (Seherr-Thoss 1979, as cited in Stokes, 1991, p.12).

In these strongly export-oriented industries, West Germany had long specialised in skilled-labour intensive, high value-added differentiated products, which were flexibly designed to customer needs (Berghoff 2006). Firms continued to concentrate on product rather than process innovation. Since quality engineering goods sold under the lucrative 'Made in Germany' label faced highly income elastic demand in both domestic and international markets, their producers managed to maintain high profitability without having to make significant real efficiency gains (Ambrosius 1993). This can be illustrated by observing the import structure in the machinery and vehicle industry in the US. Between 1948 and 1952 the share of imports from a group of European countries (including: Austria, Denmark, France, Great Britain, Norway, Italy and Switzerland) declined from almost 40 per cent to 26 per cent, and at the same time the share of West-German exports rapidly increased from 4 to almost 25 per cent. [47]

The majority of West Germany's export goods are represented by sophisticated traditional investment goods, such as machinery and electrical equipment, automobiles and chemicals and pharmaceutical products (Fischer 1978). These are the products in which West Germany had already a long-established comparative advantage. The strength of Germany's manufacturing sector in the post-war period, and specifically those industries in which it was exporting heavily, was not so much its technological superiority, but its capability to produce a wide variety of products and the flexibility of the supply.

A possible explanation for Germany's disappointing performance in the engineering sector at the end of the Golden Age is that it has been heavily affected by the coal crisis of 1958. From the end of the Second World War until the mid-1950s Germany's mining sector expanded rapidly. Coal production almost quadrupled during this period.[48] However, after the 1958 coal crisis there was a transition of European fuel consumption from coal to liquid hydrocarbons. The coal crisis was the result of multiple factors. The price of imported coal, and specifically coal from the US, was substantially lower than the price of domestically produced coal (Storchmann 2005). Furthermore, the rapid development of the oil industry in the Middle East, combined with the fall in transportation costs as result of the reopening of the Suez-Canal, resulted in fierce competition from oil. Coal demand declined as a result. This development was detrimental for heavy equipment manufacturers in West Germany as it depressed demand for several of their key products, such as coal furnaces, railway

[47] Data taken from Buchheim 1993, pp.80-81.

[48] In 1945 production was 38.9 million tons of oil equivalents, and by 1956 this was over 150 million tons of oil equivalents (Storchmann 2005, p. 1472).

locomotives and rolling stock, and coal mining equipment. As the most capital intensive and thus most productive segment of mechanical engineering was shrinking throughout the 1960s, labour-productivity growth for the industry as a whole was bound to slow down.

Britain also experienced a transition in energy usage. Before the First World War the coal industry was the single biggest employer in the United Kingdom (Dintenfass 1992). Coal was an energy source of major importance and used in factories, the iron and steel industry, electric power stations, households, steamships and so on (Turnheim & Geels 2013). However, after the First World War there was a decline in coal usage until demand increased again during the reconstruction boom after the Second World War, when coal was designated a strategic fuel (Turnheim & Geels 2012). During the second half of the 1950s demand for coal dropped as a result of competition from other fuels such as petroleum.[49] After 1957 markets further declined, with an increase in this process after 1965 when the White Paper on Fuel Policy was presented. Obviously, this had some pronounced effects on British industry and the type of machinery used.

2.7.1 The engineering sector: the shining light of British industry?

Now that we have seen that West Germany was not performing as well in engineering as usually assumed it is time to evaluate how Britain performed. As Edgerton (1994) claims there is a long tradition of declinist historiography that insists that Britain is characterised by a lack of enthusiasm for science and technology since the end of the nineteenth century. According to Edgerton, British relative economic decline cannot be blamed on failure in research and development in civil technologies, as R&D spending in the United Kingdom was higher than in other countries in the 1960s.

In the literature on Britain’s economic decline the car industry is often used as an example of an industry that performed very well in the early post-war year. Britain was the leading car exporter in the world in the late 1940s (Millward 1994). During the 1950s the British car industry was booming (Edgerton 1994; Nickell & Van Reenen 2001). The industry was dominated by three domestically owned companies, British Motor Corporations, Rootes and Standard. Additionally Ford and Vauxhall, American owned, played an important role.

Government policy after the Second World War was geared towards increasing export in cars, because there was a fragile balance of payment position (Broadberry 1997). An example of this is the control on steel supply. Firms who

[49] Petroleum usage tripled between 1960 and 1973 (Turnheim and Geels 2012, p. 41)

exported a large part of their production could obtain access to steel. One important difference between Austin, Leylands and Rover, and Standard Motors, is that Austin, Leyland and Rover maintained a diversified model range, and they only selected mass production to generate larger variety, whereas Standard Motors focuses on standardised vehicles, using only one type of engine (Zeitlin 2004). By 1958 the British Motor Corporation managed to produce half a million vehicles with the same value of net assets as Ford, who used American production techniques, but only produced 300.000 vehicles (Milward 1984).[50] After the war the United States could quickly increase its production once the steel shortage in the United States was solved, and also in continental Europe the production was increased again (Broadberry 1997). Moreover, Britain's failure to become a member of the European Economic Community resulted in considerable trade barriers for exactly that part of the world which was the fastest growing mass car market in the world (Nickell & Van Reenen). So if there was failure in this industry, we should not only look for it in the manufacturing process itself, but rather in the policy decisions made by the government.

Even though Britain could not match productivity levels of the United States, Booth (2003) still considers engineering to be the shining light of British industry since it was the industry that was very successful in closing the gap with the United States. According to the labour-productivity estimates of Smith et al. (1982, p.119) the US/UK comparative labour-productivity level was 2.26 for mechanical engineering, 3.66 for instrument engineering, and 2.66 for electrical engineering in 1968. For overall manufacturing they report a ratio of 2.76. Hence, mechanical engineering and electrical engineering are performing a bit better than average as compared to the US. Paige and Bombach (1959) reported for 1950 a US/UK labour productivity level of 3.22. Although we should be careful in directly comparing the results of Paige and Bombach and Smith et al., we can see that there was clearly some catch-up in the engineering sector throughout the long boom. The engineering sector provides a clear example of why it is crucial to evaluate manufacturing performance at the industry level. Only by examining productivity changes at the level of the industry are we able to investigate the deeper causes of productivity differences.

[50] British Motor Corporation was a merger of Austin and Morris.

2.8 Summary and conclusions

In this chapter I presented new labour-productivity comparisons which are superior to other labour-productivity comparisons for these periods for several reasons. All existing estimates for these two countries have been derived by extrapolation from distant benchmarks using time-series data, which do not take account of inter-temporal changes in relative prices and product weights. As for the mid 1930s, the currently available benchmarks all report relative levels of labour productivity for Britain and Germany within their interwar borders, and thus are not directly comparable with post-war productivity data. I use real values to calculate my productivity levels. This method is preferred over methods where for example physical output is used. I report a substantially revised benchmark for 1935, drawing on the work of Fremdling et al. (2007a), but assuring territorial and methodological consistency with my 1951 benchmark. I use a consistent industry classification throughout the pre- and post-war benchmark which makes them directly comparable. This enables me to adjust my estimates for hours worked, which is of substantial importance in the period after the Second World War when there was a substantial difference in the amount of hours worked between West Germany and the United Kingdom. Finally, I present the most disaggregate benchmark, which allows me to reveal productivity differences at a lower level of aggregation.

In the mid-1930s, West Germany commanded a respectable lead over the United Kingdom in industrial labour productivity. West Germany appeared to be especially productive in metallurgy. By the early 1950s, this pattern has been completely reversed. Relative to the corresponding British level, value added per hour worked in West Germany industry had declined by thirty per cent between 1935 and 1951. Britain overtook the lead in almost all industries; however, West Germany was still more productive in the iron and steel industry. The labour-productivity estimates which entail pre- and post-war Britain and West Germany allow me to analyse the causes of the productivity gap and the impact of the Second World War in more detail in the next chapter.

Chapter 3

Winning the war, losing the peace? A comparative analysis of labour productivity in British and West-German industry*

3.1 Introduction

The allegedly poor performance of British manufacturing is seen by some as a major cause of the relatively disappointing economic performance of Britain in the second half of the twentieth century (See Broadberry and Crafts 1992, 1996, 2001, Crafts 1996). Britain is commonly compared to West Germany in economic history studies, and there has been disagreement on the popular notion of Britain's relative economic decline vis-à-vis West Germany after 1950. While German scholars have emphasised the role of the post-war output gap in German super-growth, the recent British literature crystallised around the manufacturing failure hypothesis of Broadberry and Crafts.

In this chapter I offer a comprehensive reassessment of the relative productivity performance of Britain relative to West-German industry both before and after the outbreak of the Second World War, and in the subsequent decades, which are well-known as the Golden Age of economic growth for Westerns Europe. Clearly, as discussed in Chapter 1, the United Kingdom was bound to achieve more modest growth rates in industrial productivity as compared with West Germany, as it was closer to the productivity frontier after the war. However,

* I greatly acknowledge the extremely helpful discussions with Tamas Vonyó.

annual growth rates were still substantially lower than what should have been feasible based on the convergence hypothesis (Bean and Crafts 1996; Crafts 1995a; Crafts 1992). De Jong and Woltjer (2011) showed that at the end of the nineteenth century the United States has a labour productivity lead of around twice the level of the United Kingdom. By 1950 the United States had only increased this lead, and De Jong and Woltjer did not find a narrowing of the gap before the Second World War.

I argue that an important reason which made British productivity growth look inevitably inferior in a West-German comparison is the war-induced gap between actual and potential output, which is greatly emphasised by German scholars who argued that it was the chief catalyst of the *Wirtschaftswunder*.[1] The so-called reconstruction thesis was confirmed econometrically in cross-country investigations by both Dumke (2000) and Vonyó (2008).

It is important to distinguish between decline and failure. Whereas an industry's decline can be measured by a decreasing share in employment, and lower output, failure is much more subjective. My dissertation makes an important contribution to the literature on Britain's relative economic decline by clearly distinguishing between these two terms, which are sometimes used indistinguishably in the literature.

In this reassessment, I take into account both catch-up and reconstruction growth, and discuss their contribution to the relative economic decline of Britain during the Golden Age. My approach requires additional data that go beyond the currently available time-series evidence on productivity growth. In the previous chapter, I constructed two new methodologically consistent disaggregated labour-productivity comparisons for West Germany and the United Kingdom. These estimates allow me to evaluate how far West Germany lagged behind Britain in industrial labour productivity at the start of the Golden Age and how large an impact World War II made on the productivity race between the two economies.

The rest of this chapter is structured as follows. Section 2 discusses the changing fortunes in industry. The first part of this section focuses on the comparative productivity performance of the United Kingdom relative to West Germany. I use shift-share analysis and decomposition analysis to determine the industry-origins of the reversal of fortunes in the British-German productivity race across World War II. The second part of Section 2 deals with the changing

[1] The reconstruction thesis is attributed to Jánossy 1969. On its implication for West-German economic growth in the 1950s, see Abelshauser 2004, and Eichengreen and Ritschl 2009, among others.

position of industries within Britain. I provide a detailed discussion on the productivity performance of the British textiles industry over the course of the twentieth century. This industry provides a perfect example of the difference between relative decline and failure. Section 3 deals with the German *Wirtschaftswunder* and the role of reconstruction in the difference in productivity levels attained by West Germany and Britain. I discuss the post-war reconstruction period and the consequences for British relative economic decline. In order to do so I combine my benchmarks with time-series data to account for the role of the war-induced productivity gap in German super-growth. I show that Britain's relative decline in the 1950s cannot be attributed to British manufacturing failure. If at any time during the post-war Golden Age, such failure can be observed in the 1960s only. In Section 4, I investigate the potential explanations for the alleged poor performance of British industry, focussing on the application of Americanisation and mass production techniques, and human capital endowments. Section 5 concludes.

3.2 Changing fortunes

The pre- and post-war labour-productivity estimates for Britain and West Germany allow me to investigate, at disaggregate levels the economic consequences of the Second World War for manufacturing industries in Britain and West Germany. Unfortunately, not many statistics on productivity and performance are available for the war period, which hugely complicates calculating any measure of labour productivity. Estimating labour productivity for individual industries is especially problematic due to the lack of reliable price information, and estimates of output of separate industries. Broadberry and Howlett (1998) made an attempt to calculate labour-productivity levels for Britain during the period 1939-1946. They use GDP per head as an indicator of labour productivity, and are able to show that by 1946 the level of GDP per employee is only 3.8 per cent higher than it was by 1938, which seems to be a relatively small increase, when compared to peacetime standards (Broadberry and Howlett 1998, p.44-46). [2] Most of the exceptional growth of productivity in Western Europe materialised after the war.

This section focusses on shifting fortunes at the disaggregate industry level. Knowing how the British-German productivity race advanced over the course of the Second World War is of substantial importance for the debate on failure and

[2] For literature on the performance and problems of economies during the war see e.g. Harrison 1998; Milward 1977; and Ránki 1993.

relative economic decline in British manufacturing. As discussed in Chapter 1, I expect that part of Britain's disappointing growth performance in industry is simply the effect of the so-called inevitable causes, such as structural change, and less potential for catch-up, convergence and reconstruction growth. Therefore, I assess at the disaggregate industry level how British and West-German manufacturing industries performed before and after the Second World War. This allows us to evaluate whether there was room for catch-up and reconstruction growth in West Germany, and whether this implies that Britain was bound to have lower growth rates. If so, this would imply that there is not necessarily failure in the British economy.

3.2.1 The structural component of the aggregate productivity gap

The greatest merit of disaggregated productivity comparisons is that they allow us to measure the contribution of individual industries to and the role of structural effects in the productivity performance of different economies. I conduct a shift-share analysis to evaluate which were the most important drivers of the labour-productivity gap between Britain and West Germany, structural differences within industry, or different labour-productivity levels across industrial branches.

3.2.1.1 Shift-share analysis

Shift-share analysis has been developed to distinguish between sector- (or region) specific and inter-sectoral (or inter-regional) effects in accounting for aggregate patterns. Shift-share techniques were pioneered in the 1960s and have since been used in different applications, mostly in regional studies of employment expansion. The specific formulas that I employ to measure the contribution of structural shifts to the aggregate labour-productivity gap are taken from a comparative study of Jaap Sleifer (2006, p.60) on East and West-German economic development.[3] Sleifer applies two different specifications, a static model and a dynamic model.

$$LP^{UK} - LP^{D} = \sum_{i=1}^{n}\left(LP_i^{UK} - LP_i^{D}\right)\frac{1}{2}\left(S_i^{UK} + S_i^{D}\right) + \sum_{i=1}^{n}\left(S_i^{UK} - S_i^{D}\right)\frac{1}{2}\left(LP_i^{UK} + LP_i^{D}\right) \qquad \textbf{[3.1]}$$

[3] Sleifer derived the equations from Timmer 1999, p102-105.

In the static model, the aggregate labour-productivity gap between the two countries is explained by (1) an intra-sector effect that accounts for differences in labour-productivity levels within each industry assuming equal shares in total labour input, and (2) a shift effect that measures the impact of structural advantages on aggregate productivity performance assuming equal branch-specific labour-productivity levels. In the above equation, the shift effect will be positive if high-productivity industries have a larger share in total labour input, measured by hours worked, in Britain than in West Germany.

The dynamic model is typically used in inter-temporal investigations, but it can also be interpreted in a cross-sectional examination.[4]

$$LP^{UK} - LP^{D} = \sum_{i=1}^{n}\left(LP_i^{UK} - LP_i^{D}\right)S_i^{D} + \sum_{i=1}^{n}\left(S_i^{UK} - S_i^{D}\right)LP_i^{D} + \sum_{i=1}^{n}\left(S_i^{UK} - S_i^{D}\right)\left(LP_i^{UK} - LP_i^{D}\right) \qquad \textbf{[3.2]}$$

In the dynamic model the aggregate labour-productivity gap between the two countries is explained by three factors. The first is an intra-sector effect that accounts for differences in labour-productivity levels within each industry assuming that both countries have equal labour shares, in this case the West-German share. The second effect is a static shift effect that measures the impact of structural advantages on aggregate productivity performance assuming equal branch-specific labour-productivity levels, in this case the West-German productivity level. The third effect is a dynamic shift effect that accounts for differences in the labour share of those industries where the branch-specific productivity levels differ most between the two countries. Thus, the first part considers the intra-branch effect and parts 2 and 3 combined measure the structural change effect.

The dynamic shift effect of the above equation will be positive if Britain has larger shares in total labour input than West Germany in those industries where it has an advantage in labour productivity, or smaller labour shares in those industries where it is lagging behind in terms of productivity.

I use value added per hour worked as a measure of labour productivity in this analysis. Table 3.1 reports the results that I have obtained by running the two specifications on my benchmark data sets.

[4] Although it might be somewhat unusual to call an analysis on a cross section dynamic, the name is used her since this type of shift-share analysis is commonly known as the dynamic shift share model.

Table 3.1: Decomposing the aggregate labour-productivity gap between United Kingdom and German industry 1935 and 1951

	Percentage of labour-productivity gap explained by:			
	Intra-sector effect	Shift effect		Total effect
1935	76.78	23.22		100
1951	87.73	12.27		100
	Percentage of labour-productivity gap explained by:			
	Intra-sector effect	Static shift	Dynamic shift	Total effect
1935	79.86	26.29	-6.16	100
1951	92.41	16.95	-9.37	100

Note: The effects are expressed as percentages of the aggregate productivity gap. I excluded tobacco from the analysis since there is an extreme difference in labour productivity in this industry, and this is the result of the different commodities produced.

Source: Calculations based on labour-productivity estimates as calculated in Chapter 2. See Table 2.1 and Table 2.4 for the underlying sources.

In the static model I find for 1935 that the positive intra-sector effect explains 76.78 per cent of the gap, and the positive shift effect explains 23.22 per cent. The positive shift effect indicates that Britain had a higher share of its hours worked devoted to industries with high productivity levels. This effect accounts for almost a quarter of the productivity difference between the two countries. A positive intra-sector effect explains almost 90 per cent of the variation in labour-productivity in 1951, the impact of the shift effect is just over ten per cent. Hence, after the Second World War there were minor differences in the employment structure within industry in the two countries. Structural differences were more important in the pre-war period.

The result of the dynamic analysis indicates for both years a small negative dynamic shift effect.[5] Apparently West Germany had larger shares as compared with Britain in those industries were Britain had the advantage, and Britain had larger shares in those industries were it did not have an advantage. Britain could have had a larger lead over West Germany if it had a different industry structure. Tables 3.2 and 3.3 below presents the allocation of total hours worked in manufacturing and the share of value added in both West Germany and Britain for

[5] In equation 3.2, I employ the West-German labour share and labour productivity level. Obviously, it is possible to rewrite this formula and use the shares of the United Kingdom. For 1951 the results change slightly, the intra-sector effect accounts for 83.04 per cent of the total gap, the static-shift effect accounts for 7.59 per cent, and the dynamic-shift accounts for 9.37 per cent. For 1935 these shares become respectively 73.71, 20.14 and 6.16. Hence, my main conclusion that the intra-sector effect is most crucial in explaining the UK/West-German labour-productivity gap remains valid.

the 24 industries covered in the labour-productivity estimates for both 1935 and 1951.

For 1951 we see that Britain had a lower share of total employment in some industries were it had the productivity advantage, such as non-ferrous metals, building materials and woodworking. This contributed to the negative dynamic shift. West Germany had a larger share of employment in some industries were it had the lead, such as chemicals, glass, timber and paper, which also contributed to a negative dynamic shift effect for Britain. For 1935 we find that Britain had a larger share in textiles, even though West Germany had a productivity lead in this industry. Moreover, West Germany had a much higher share of labour employed in the iron and steel industry, where it had a substantial advantage over Britain. As a result we observe a negative dynamic shift effect for 1935.

When we compare the pre- and post-war analysis we observe not much difference in the effects over time. Most important is that we see that the employment structure became more equal after the war than before the war. This implies that structural changes played a more important role in explaining the difference in aggregate productivity before the war. In both years the intra-sector effect appeared to be the single most important determinant of the aggregate labour-productivity difference. This result, combined with the large variation in labour-productivity differences over industries we found in Chapter 2 reveals that indeed we should analyse Britain's performance at the disaggregate industry level.

Table 3.2: Distribution of value added and hours worked in manufacturing in West Germany and the United Kingdom in 1935

	Percentage share in total value added		Percentage share in total hours worked	
	West Germany	United Kingdom	West Germany	United Kingdom
Coal Mining	7.59	10.49	9.60	12.82
Textiles	8.35	12.75	12.34	19.02
Leather	1.26	0.89	1.75	0.94
Footwear	0.94	1.68	1.92	2.13
Clothing	1.82	5.09	2.96	7.16
Iron and Steel	17.02	7.84	14.81	7.67
Non Ferrous Metals	2.75	2.44	2.05	2.17
Fabricated Metal Products	2.16	1.70	2.60	2.00
Vehicles	4.50	5.38	4.20	5.13
Mechanical Engineering	11.55	8.20	11.43	7.93
Electrical engineering	7.69	4.80	5.98	4.54
Optical and Precision Engineering	1.69	0.63	1.90	0.62
Beverages	3.80	10.25	1.85	1.91
Food	4.78	6.60	4.89	7.73
Chemicals	6.25	7.40	3.17	3.54
Glass	0.68	0.88	0.83	0.85
Building Materials	5.65	2.86	6.87	2.47
China and Earthenware	0.87	0.78	1.19	1.26
Woodworking	3.58	1.96	3.46	2.34
Timber	2.51	1.15	1.87	1.25
Paper	2.57	2.29	2.17	2.97
Rubber and Asbestos	1.34	1.45	1.22	1.21
Miscellaneous	0.66	2.46	0.93	2.35

Source: own calculations, see Table 2.4 for the underlying sources.

Table 3.3: Distribution of value added and hours worked in manufacturing in West Germany and the United Kingdom in 1951

	Percentage share in total value added		Percentage share in total hours worked	
	West Germany	United Kingdom	West Germany	United Kingdom
Coal Mining	6.59	7.89	10.29	11.47
Textiles	15.40	15.72	11.84	13.38
Leather	1.42	0.86	1.16	0.67
Footwear	1.29	1.12	1.76	1.53
Clothing	2.17	3.33	4.25	5.79
Iron and Steel	9.55	7.73	7.58	7.90
Non Ferrous Metals	1.95	2.01	1.84	1.65
Fabricated Metal Products	1.32	2.91	3.20	3.32
Vehicles	5.05	5.08	5.10	5.20
Mechanical Engineering	10.50	10.55	11.87	11.95
Electrical engineering	4.39	6.94	6.30	8.46
Optical and Precision Engineering	1.74	0.98	2.03	1.20
Beverages	3.95	8.84	1.49	1.80
Food	7.88	6.47	4.91	6.70
Chemicals	9.81	6.45	6.72	4.83
Glass	1.28	0.82	1.25	1.01
Building Materials	3.23	1.96	5.06	2.17
China and Earthenware	0.81	0.79	1.50	1.21
Woodworking	2.81	1.66	4.25	2.26
Timber	2.04	0.96	2.12	1.28
Paper	4.77	3.52	2.75	2.57
Rubber and Asbestos	1.14	1.66	1.33	1.63
Miscellaneous	0.91	1.75	1.33	1.98

Source: own calculations, see Table 2.1 for the underlying sources.

3.2.1.2 Decomposition analysis

In this section, I employ simple analytical tools to decompose the aggregate labour-productivity gap that I have estimated between Britain and West Germany in 1951, into industry contributions and the impact of structural differences. These structural components, in turn, do not only help to better explain the aggregate productivity gap at the start of the post-war Golden Age. They also have important implications for the comparative growth performance of the two nations in the manufacturing sector during the Golden Age itself. The initial productivity gap can indicate the difference in the distance to the world frontier and thus in the scope for catch-up growth, whereas differences in the relative weight of high- or low-productivity industries in the two economies can also explain trends of divergence between their subsequent growth paths.

My benchmarks are of higher quality than previously published estimates and they are much more disaggregated. This disaggregation allows for a decomposition study. Decomposition techniques are frequently used in disaggregated growth accounts to exploit the richness of data in order to gain a better understanding of the aggregate growth processes. The exact specification is derived from the recent work of Timmer and associates (2010, p.153-154).[6] I modified their model slightly, in order to make it applicable to cross-sectional examination. Aggregate nominal value added (Y) is defined as the sum of nominal value added (Z) over all industries (j).

$$P^{y}Y = \sum_j P_j^Z Z_j \qquad \textbf{[3.3]}$$

Labour productivity in a given industry (j) is, in turn, computed as value added in the respective industry divided by the number of employees or labour hours (L).

$$z_j = Z_j / L_j \qquad \textbf{[3.4]}$$

Aggregate labour productivity is defined as a weighted average of labour-productivity levels in all industries, where the weights represent the share of industry (j) in value added.

$$Y/_L = \sum_j v_{Z,j}^{Y}\, z_j \qquad \textbf{[3.5]}$$

[6] The authors applied the above model to decompose GDP growth.

In a comparative framework, the aggregate labour-productivity gap between two countries can be decomposed into a set of industry contributions, where the industry-specific benchmarks are weighted by the average of their value added shares between the two countries, and a residual.

$$\frac{Y/L_A}{Y/L_B} = \sum_j \upsilon_{Z.j}^{Y} + \left(\sum_j \Delta \ln L_j \bar{\upsilon}_{Z,j}^{Y} - \Delta \ln L \right) = \sum_j \upsilon_{Z.j}^{Y} z_j + R \quad \textbf{[3.6]}$$

The residual, which in disaggregated growth accounts is referred to as the reallocation effect, measures the contribution of differences between the two countries in the composition of their labour input to the aggregate labour-productivity gap. It is positive whenever industries with above-average levels of labour productivity have a larger weight in the country of the numerator (A).

Table 3.4: Decomposing aggregate labour productivity in West-German industry (UK =100)

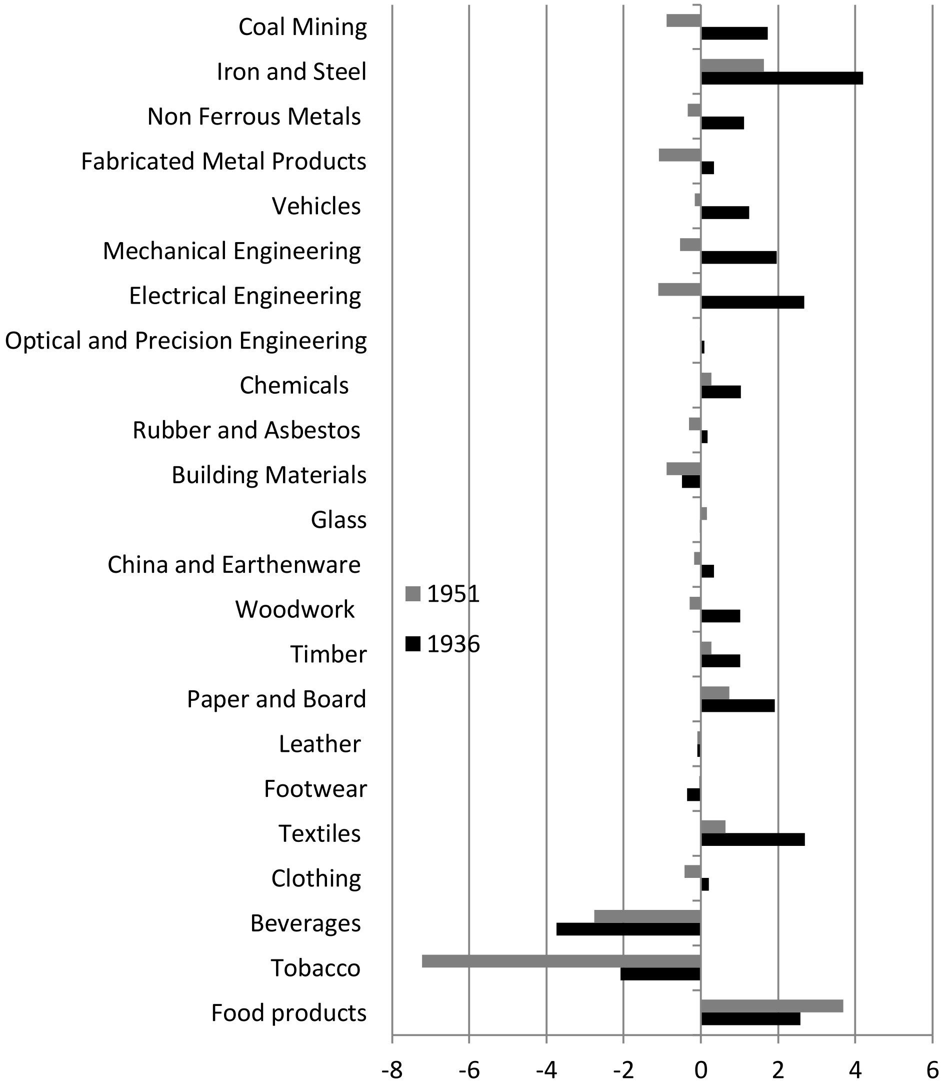
	1935	1951
Aggregate labour productivity (24 industries)	111.5	85.1
Industry contributions	117.4	90.7
Residual	-5.9	-5.6

Sources: see text.

Table 3.4 reports the results obtained by this decomposition for my two benchmarks for industrial value added per hour worked. Note that the aggregate labour productivity reported here is the total labour productivity level of the 24 industries, whereas the aggregate labour productivities reported in Chapter 2 were for the whole industrial sector. The total manufacturing gap reported in Chapter 2 includes additional industries, therefore, the two numbers are not exactly the same, albeit they are very close. Table 3.4 confirms that neither the gap between the two countries in total industrial labour productivity nor the shifting of their relative positions between the mid-1930s and the early 1950s can be explained by structural differences within the industrial sector. Individual industry contributions would have produced very similar results had the two economies exhibited exactly the same industry weights in manufacturing employment. British industry had a small structural advantage in both periods, meaning that its productivity level relative to West Germany would have been slightly smaller in both 1935 and 1951 based on the individual industry contributions alone. However, this advantage amounted to only a few percentage points. This finding is in line with the results from the shift-share analysis, where I found a positive static shift effect, which was larger than the negative dynamic shift effect.

There is an important contribution that this decomposition analysis can make though. The decomposition allows us to reveal the impact of individual industries on the aggregate productivity gap. Figure 3.1 depicts the contributions of individual industries to the aggregate labour-productivity gap between West Germany and the United Kingdom on a horizontal bar chart. The bars represent the percentage point deviation of the productivity levels attained in each industry in West Germany from the corresponding British levels, weighted by the average share of the respective industries in total manufacturing value added between the two countries. The diagram confirms that Britain had managed to establish a lead in almost all industries by 1951, even in sectors where West Germany was clearly superior before World War II. I can observe major shifts in the relative importance of the different industries in explaining the change of fortunes in the British-German productivity race. The main reason for West Germany's falling behind was clearly the sharp deterioration of its productivity position in the principal war industries: iron and steel, metal products, machine tools and transport vehicles, electrical engineering and chemicals. In iron and steel, chemicals, and textiles, West Germany managed to preserve some of its vast superiority, but even here, British industry had closed most of the pre-war gap. West Germany's relative position had improved across the war only in the glass industry, paper and board, and in food products.

Figure 3.1: Industry contributions to the aggregate manufacturing labour-productivity gaps



Source: own calculations based on labour-productivity estimates calculated in Chapter 2. See Table 2.1 and Table 2.4 for underlying sources.

As noted in Chapter 2, the tobacco industry is a special case. The already sizeable British productivity lead in the 1930s increased after the war due to the fact that technological shift from cigar to cigarette production explained in the previous sections was faster than in West Germany. The mass demand for cigarettes born out of wartime experience all over Europe also meant that both the actual volume and the price of tobacco products relative to other manufactures had increased substantially across the war. The average share of the tobacco industry in total manufacturing value added between the two countries jumped from a mere 2.6 per cent in 1935 to 8.4 per cent in 1951. Figure 1 shows that over half of the aggregate German productivity lag in 1951 was the contribution of the tobacco industry. In fact, with the exclusion of tobacco manufactures, labour productivity in West-German relative to British industry would increase from 85 per cent to 92 per cent. This finding provides a perfect example for how helpful decomposition techniques are in explaining aggregate growth processes or, in this case, comparative industrial performance. In the next section I focus on shifting fortunes and changing positions of industries within Britain.

3.2.2 Shifting fortunes in Britain

In this section I evaluate how the productivity performance of individual industries within Britain evolved over time. Until this point, I have been focusing on comparisons with West German, however, shifting fortunes within Britain can also be very useful indicators for relative economy decline and failure.

Table 3.5 below shows for the 12-industry classification the position each industry had in terms of value added generated per hour worked in 1935 and 1951 in the United Kingdom. In 1935, the most productive industry in terms of value added per hour worked was chemicals, followed by the food, drink and tobacco industry. Value added in chemicals per hour worked was twice as high as value added per hour in total manufacturing. Clothing and footwear, and textiles were the least productive industries in terms of value added generated per hour worked.

By 1951, the food industry is the most productive industry, followed by chemicals. The final column of Table 3.5 shows the ratio of total hours worked for 1935/1951. This demonstrates how much larger or smaller an industry became after the war in terms of working hours. In total manufacturing, there was an increase of approximately 20 per cent in the total number of hours worked in 1951 as compared to 1935. The largest increase in hours worked took place in the chemicals industry, where more than 60 per cent extra hours were reported in 1951. There was a decrease in the total hours worked in leather, clothing and footwear, and textiles trade.

Overall, we can see that by 1951 many industries remained very close to their relative position in 1935. The most spectacular change in relative position is made by the textile industry. It increased its position on the list from the 12th to the 8th place. Although later in this chapter I will shift the focus towards the underlying causes of Britain's relative economic decline, the next section will already briefly investigate the developments in the textiles sector, as it has historically been a large and important sector in British industry. The evolution of the textiles sector over the course of the twentieth century provides a perfect example of how important it is to distinguish between failure and decline.

Table 3.5: Relative position of industries in the UK in 1935 and 1951 in terms of value added per hour worked

Industry	VA p.h. 1935 index[a]	position 1935	VA p.h. 1951 index	Position in 1951	ratio of total hours worked 1951/1935
Chemicals and allied trades	205	1	123	2	1.61
Food, drink and tobacco	171	2	280	1	1.12
Paper trades	121	3	103	3	1.02
Miscellaneous Trades	107	4	85	5	1.19
Engineering and vehicle trade	102	5	80	7	1.85
Iron and steel	99	6	103	4	1.36
Clay and building materials	97	7	75	9	1.13
Leather trades	93	8	85	6	0.85
Woodwork	85	9	70	10	1.11
Mining	80	10	63	11	1.05
Clothing and footwear	71	11	55	12	0.93
Textiles trade	66	12	80	8	0.83
Manufacturing (Total)	**100**		**100**		**1.19**

Note: a. total manufacturing is 100, the index is based on current prices. Value added per hour worked in 1935 was £0.10 per hour worked in current prices; in 1951 this was £0.40 per hour worked in current prices. Using the index of wholesale prices from the Business Statistics Office (1978). I find that this translates to £0.12 per hour in 1951 in 1935 prices, which implies an increase of 23 per cent in total value added per hour worked generated in 1951 as compared to 1935.

Sources: Value added and employment are taken from Board of Trade (1954), 'The Report on the Census of Production for 1951'; Board of Trade (1938-44), 'Final Report on the Fifth Census of Production and the Import Duties Act Inquiry 1935, pt. 1–4'. Hours worked for 1951 are obtained from O'Mahony (1999), for 1935 hours worked are obtained from Department of Employment and productivity (1971), 'British Labour Statistics, Historical Abstract 1886-1968'.

3.2.2.1 *Britain's textile industry during the twentieth century: an illustration of failure or decline?*

The textiles industry provides a very important case study for investigating Britain's relative economic decline. The decline of the British cotton industry is used in the literature as a clear example of manufacturing failure. Most notably by Lazonick (1981, 1986), who argues that Britain was failing in this industry because it did not develop modern corporate structures using high throughput capital-intensive techniques. Already at the end of the nineteenth century the most important region for textiles in the UK, Lancashire, started to decline. Before the First World War more and more nations tried to set up their own cotton industry, which was usually protected with tariffs. These protection schemes were harmful for British exports (Sandberg 1974). Whereas in the beginning of the 1930s Britain exported 137 million pound of cotton yarn, and 2490.5 million linear yards of piece goods, this had fallen to respectively 65.5 million pound and 857.8 million linear yards by 1951 (Robson 1957 p.332-333 as cited in Broadberry 1997a, p. 249).

Table 3.6 presents the annualised growth rate of value added per hour worked for sub-branches in the textile industry for three periods from 1935 till 1968.[7] The period 1935-1948 is characterised by negative labour-productivity growth rates in almost all textile branches, except in spinning and doubling on the cotton and flax system, which presents 17 per cent of value added generated in textiles in 1948. Also the miscellaneous textile industry witnessed a small increase in productivity, however, this industry is of minor importance. Compared to other industries this decline in labour productivity is not very severe, which explains why the textile industry could overtake some other industries in terms of labour-productivity.

The period 1948 to 1958 is also characterised by decreasing labour productivity. The period 1958 to 1968 displays relatively high growth rates in labour productivity for certain branches. The period directly after the Second World War was relatively favourable for the British cotton industry, as other countries struggled to replace war torn capacities (Millward 1994). However, in the early 1950s cotton cloth exports were already dramatically lowered, and there was severe competition from abroad.

[7] I used the wholesale price index from the Business Statistics Office (1978) For the period 1930-1949 there are three separate price indexes for textiles, namely one for cotton, one for wool and one for other textiles. For the period thereafter only one index is available. Data for the period until 1962 is lacking in the historical record. Therefore, I relied on the wholesale price index from the 'Annual Abstract of Statistics 1958'.

Table 3.6: Labour-productivity growth rates (%) and total hours worked in British textile industry (1935 – 1968)

	Annualised labour productivity growth rates			Index of total hours worked (1935 = 100)		
	1935-1948	1948-1958	1958-1968	1948	1958	1968
Production of man-made fibre	-2.04	0.02	8.98	85	94	98
Spinning and doubling on the cotton and flax systems	2.87	-4.02	6.92	79	65	35
Weaving of cotton, Linens and man-made fibres	-	-4.08	5.61	-	110[a]	35[a]
Woollen and Worsted	-0.55	-5.17	4.22	82	81	58
Jute	-1.62	-1.81	4.4	68	66	53
Rope, Twine, Net	-1.4	-2.12	3.65	93	79	48
Hosiery and Other knitted goods	-1.38	-2.67	4.88	79	94	103
Lace	-0.47	-5.25	4.21	74	63	29
Carpets	-1.87	-1.51	3.52	75	102	133
Narrow Fabrics	-1.72	-2.63	3.87	99	104	92
made-up household textiles	-	-6.88	4.72	-	282[a]	276[a]
Canvas Goods and Sacks	-2.37	-0.98	2.14	125	128	88
Textile Finishing	-2.78	-2.35	4.41	75	72	47
Asbestos	-3.02	-2.97	2.96	202	259	268
Miscellaneous textiles	0.23	-3.11	6.91	118	112	103

Notes: a. data for 1935 was not available, thus 1948 is set to 100.

Sources: Employment, value added and the wholesale price index are taken from Business Statistics Office (1978). Hours worked is obtained from O'Mahony (1999) and Department of Employment and productivity (1971), 'British Labour Statistics, Historical Abstract 1886-1968'.

Table 3.6 also presents an index of total hours worked in the textile industry for 1948, 1958 and 1968. Interestingly, the decline in working hours was especially severe in spinning and doubling on the cotton and flax systems. In weaving of cotton, linen and man-made fibres there was a large decline in the amount of hours worked during the 1960s. In terms of gross output this industry decreased by almost 40 per cent between 1948 and 1968.

British cotton industry relied on old technologies, such as the mule and Lancashire loom, until the 1960s. Whereas in the United States all looms were automatic in the mid-1950s, in Britain only just over ten per cent were automatic (Lazonick 1981, p.32).

In 1959 the Cotton Industry Act offered manufactures of cotton compensation if they would scrap their old and redundant machinery and mills (Lee 1996). A total of 678000 ring spindles and 11000 automatic looms were purchased with the subsidies; the total investment amounted to 53.5 million pounds, whereas the government had hoped to reach an investment of at least 80 million pounds (Singleton 1991). Hence, this incentive was not as great of a success as hoped for. However, according to Millward (1994) there is rationale behind the decision of British entrepreneurs to stick to older production methods, since there still was a large skilled labour force, an inheritance from the industrial revolution. Another explanation for the lack of the adoption of new techniques that Millward mentions is that there were many small or family-owned firms. These small firms could not afford the large investments needed for the introduction of mass production techniques. Mass and Lazonick (1990) argue that the decline in the British cotton industry was the result of outmoded economic individualism, whereas collective response was required to be able to compete with other nations

According to Lazonick (1981) managers failed to create new profitable opportunities. In contrast, Sandberg (1974) argues that the decline of British textile industry is not the result of technological backwardness nor of failure to invest in new types of machinery.[8] Sandberg believes that the decline can for the largest part be ascribed to a change in comparative advantage, and obviously Britain could not compete with low-wage countries. Therefore, the decline of the industry can be seen as inevitable. Broadberry (1997a) agrees with the idea that to a large extent the decline of the industry was simply a shift in comparative advantage, however, he believes that the process was speeded up by the action of managers between the world wars. Hence, although Broadberry does not believe that the decline of the textile industry is solely the result of failure, he argues that there was room for failure.

According to Singleton (1991) the cotton industry was overwhelmed with the threat of cheap imports, and pessimism about future prospects hampered investment. Singleton (1991) argues that in general businessmen in cotton had very long planning horizons, and their decisions not to install new machinery was sensible since the only textile industries in developed countries that thrived were those that were heavily protected, such as in the United States. The textile industry provides a perfect example of how comparative advantage influences an economy. Even though Britain once had the advantage, with numerous skilled labourers who could operate textile machinery, the mass production techniques introduced during the nineteenth and twentieth century simply asked for unskilled cheap labourers. Therefore, Britain was not able to remain the leader in the textile industry, since

[8] There is no evidence that firms that did install automatic looms in the first decade of the twentieth century did make faster or larger profits than their more conservative competitors.

the introduction of new technologies, which were non-neutral, changed the requirements for a successful business and called for substitution. Britain could simply not meet these new requirements.

The textile industry example demonstrates how important it is to clearly distinguish between the terms decline and failure. Decline is objective; it refers to an industry that is decreasing in size, as measured by employment and/or output. Concluding that an industry is failing, on the other hand, is a much more subjective statement. Failure implies that if other decisions had been made by the representatives, decline would not have been the result. It is very important to keep this distinction clearly in mind, since it plays a large role in the debate on Britain's relative economic decline which is discussed in the remainder of this chapter.

3.3 Reconstruction growth in West Germany

A part of German's super-growth might be the result of the setback West Germany experienced as a result of the Second World War. In this section I will focus on the effect of reconstruction growth in Britain's relative economic decline, and specifically on how its position changed in comparison to West Germany. Although Britain was not as severely hit as West Germany and not much capital was destroyed, there were severe issues after the war. The balance of payment deficits were extremely large, and Britain had a massive overhang of unspent money balances, which was the result of forced saving and the repressed inflation of the wartime economy (Crafts 1993;1994). This situation had a significant impact on its possibilities for growth after the war. But in the remainder of this section I will focus on the effects of the war on West Germany, and how this influenced West-German productivity. I will first briefly elaborate on the deconstruction of capital in West Germany, and then I discuss reconstruction growth. By understanding West Germany productivity growth, we can also better understand the case of Britain's relative economic decline.

3.3.1 The bombing of Germany

Already before the end of the war the United States Strategic Bombing Survey (USSBS) reported on the effectiveness of Allied bombing and the remaining production capacity of Germany. Although destruction rates in the country's major cities reached 75 per cent or more in city centres, the material damage in West Germany was of a small magnitude according to the USSBS (1945, p.37). The survey stressed that the Allies never attempted to destroy the German economy, but rather to stop it from operating by damaging key points. Mid 1944 Allied Strategic Bombings targeted electric power, synthetic fuels generation, and railroad networks, in an attempt to disrupt the supply chain instead of destroying productive capacity (Birkenfeld 1964). The air bombardments of transportation infrastructure and the Ruhr area had a substantial effect. Although coal production itself was not too heavily affected, since most of the operational facilities of coal mines are underground, the effects of bombing of transport routes had a large impact (USSBS 1945, p.99). Only 17.4 per cent of industrial fixed assets on the territory of the later West Germany was destroyed as a consequence of aerial bombardment and ground fighting, and a mere 6.5 per cent of all machinery and equipment suffered significant damage (Krengel 1958 cited by Abelshauser 2004; Vonyó 2012). Coal supply was disrupted because transport from the pitheads to power stations and factories became increasingly difficult (USSBS, 1945, p. 99; Eichengreen & Ritschl 2009). The effects of the shortage of raw materials and the energy crisis persisted well into 1947 (Eichengreen & Ritschl, 2009).[9] Quick recovery was possible because the productive capacity was not severely damaged, but only infrastructure and supply chains were.

It is difficult to construct reliable estimates of the fixed industrial assets in the Federal Republic at the end of the war due to data limitations. It is assumed, however, that the amount of assets was higher than in 1939 (Braun 1990). Investments during the war were very likely to exceed the damages done by the war, which means there was a built up of capital (Braun 1990). Krengel (1958) showed that the age structure of fixed assets in industry was more favourable in 1948 than 1935. Whereas by 1935 only 29 per cent of capital was under 5 years, by 1948 this share had grown to 50 per cent. (Krengel 1958, p.52-53). Thus, capital in Germany was not in a poor state after the war.

3.3.2 The Reconstruction Thesis

Reconstruction growth can be explained within the neoclassical growth framework. The war destroyed productive capacities which implied a temporary deviation from the steady state. The gap that exists between actual output and a country’s technological potential combined with the changed ratio of factors of production due to the destruction of capital plays a major role in initiating high growth rates. Figure A-2.1 in the Appendix illustrates in a basic graph the idea

[9] In 1947 coal production in Germany was only at 52 per cent of its 1938 level, whereas in Britain output already reached 87 per cent of the pre-war level (Eichengreen and Ritschl, 2009, p.200, Table 3).

underlying the reconstruction thesis of Jánossy (1969) and demonstrates how the West-German and United Kingdom growth performance fits into this framework.

In the early reconstruction phase, between 1947 and 1950, GDP per capita grew over 15 per cent per annum in West Germany (Maddison 1995). Part of the growth miracle of West Germany was indeed simply a return to the steady state. However, in the beginning of the 1950s West Germany was already back at its pre-war GDP per capita level. Thus, this type of reconstruction growth is only capable of explaining part of the growth miracle. The reconstruction thesis can be seen in a framework of an extended neoclassical growth model in which human capital is not a separate part of the production function, but enters in a labour-augmenting form such as in the model of Hall and Jones (1999). In Jánossy's (1969) interpretation of a 'potential growth path', growth is not limited to a historical trend, but depends on the potential of the economy, which in turn depends on the stock of labour, physical capital and human capital. Jánossy stressed the importance of the qualification structure of the labour force.[10] In the Jánossy model there is a constant capital over human capital augmented labour ratio in the steady state.[11]

Several scholars have defined reconstruction as the period directly after the war time shock in which countries grow back at their pre-war level of welfare (Cairncross 1951). If we would use this definition we would conclude that by 1953 reconstruction was completed, because by then West Germany's GDP per capita was back at its 1938 level. This period in which a country retains its pre-war level of GDP represents the recovery period, *wiederaufbau* or pure reconstruction (Dumke 1990, Smolny 2000). Table 2.5 in Chapter 2 revealed that the 1935 level of output per man-hour worked was surpassed by 1951.

However, the reconstruction thesis, as developed by Jánossy, actually states that a country should be back on its potential growth path. This implies that reconstruction growth only ends when the actual level of production equals the level of production that West Germany would have attained if the Second World War had not taken place. The trendline that Jánossy refers to is a line that dictates how large production could have been, in case of no economic disturbances. Jánossy (1969, p. 12) states the following '*the trend line of economic development must be defined as a top limit curve of the line representing the actual production*

[10] However, the important question in the neoclassical growth model is how far a country is from the international frontier, whereas in the reconstruction model we are interested in the distance to the national frontier, which is some sort of theoretical frontier.

[11] It can also be viewed in the context of an endogenous AKH model such as used by Crafts (1995a) in his paper on the Golden Age as a potential model.

level. Thus, the trend line must not be determined as an average production-level line, i.e. not as a line running between the maxima and minima of production, but as a curve that connects the maxima of the production level line, thus bridging the gaps in production caused by disturbances. (Original emphasis)*'*. Therefore, for many countries this is a sort of 'hypothetical' line, which the country might never or only occasionally reach. Although Jánossy referred to the potential growth path of a country, other scholars have interpreted this as the 'historical normal long run growth path'.[12] There are some problems in defining a country's 'historical normal long run growth path' and this concept has received much critique. Bombach (1985), for example, has argued that the geographical area of Germany changed markedly over the World Wars and large labour migration changed the composition of the population, making it hard to argue that there is such a growth path for West Germany. However, the main problem in defining a trend line as Jánossy envisaged, is that the first half of the twentieth century witnessed two major shocks that prohibited the German economy from operating at full potential: the First World War, and the worldwide economic crisis. Therefore, it is expected that before the outbreak of the Second World War West Germany was not on its trend line of undisturbed economic growth. Simply extrapolating West Germany's growth before the world war will thus not result in the trend line. This also implies that reconstruction growth for West Germany was not only the result of recovering from the Second World War, but it could also reflect recovering from the relative poor performance during the interwar period. Moreover, the Second Industrial Revolution allowed for higher growth rates, hence the long-run trend line of growth does not need to exhibit a constant growth rate.

Quantitative research found some support for the reconstruction thesis. Crafts and Mills (1996) concluded that for ten European countries the reconstruction hypothesis cannot be rejected, but they find little support for the longer-run dynamics properties of the reconstruction thesis. Crafts and Mills find that Jánossy's emphasis on the importance of reconstruction in the early post-war

[12] See Dumke 1990, among others.

growth is important, but the suggestion of a constant 'historical normal' rate of growth on a traditional neoclassical natural rate model is generally not valid.[13]

To conclude, I believe that reconstruction indeed played a significant role in West Germany's fast growth rates after the Second World War. However, West Germany continued to exhibit spectacular growth rates after the 1950s, when it should be expected that it was back on its long run growth trajectory.[14] Table 3.7 depicts labour-productivity growth rates for West Germany and the United Kingdom for the period 1951 to 1968. Close inspection of Table 3.7 reveals that West-German growth rates after 1960 where higher than before 1960 in some important industries. In chemicals, for example, growth rates are even in double digits in the second half of the 1960s, which was the result of the introduction of new technologies. In Britain one can also see a spurt in growth rates in the chemical industry during the second half of the 1960s. In the mid-1950 there was a change in the production of organic chemicals as compared with the pre-1950 period. Whereas in 1950 less than one-sixth of organic chemicals was produced with the use of petroleum or gas, by the mid-1950s this was over 50 per cent, and by 1964 more than two-third of the output was produced by using petrochemicals (Stokes, 1991, p. 12, figures were drawn from Shworm, 1967, pp. 54, 56-57).

During the 1960s, the growth rate of most West-German industries was still substantially higher than the growth rate of British industries, although the differences in growth rates become gradually smaller. In the last period of the 1960s, Britain reports higher labour-productivity growth rates in a few industries: mechanical engineering; vehicles; textiles; clothing and footwear; and building materials. These industries together accounted for roughly one-third of gross output produced in manufacturing in 1968.[15] This indicates that a substantial part of the West-German overtaking took place after the 1960s. By that time we should expect that reconstruction growth is completed. Hence, although I believe that

[13] Vonyó (2008) found that for core western industrialised nations, the rapidity and variety of economic growth during the 1950s and 1960s can mostly be explained by post-war reconstruction. Dumke (1990) finds for 16 OECD countries that reconstruction growth is economically and statistically significant.[13] He concludes that this type of growth was especially important for Germany. Smolny (2000) estimated that approximately one third of labour-productivity growth in Germany during the 1950s was caused by reconstruction growth and about half can be explained by catching up to the United States. The productivity gap hypothesis and reconstruction together explained about 90 per cent of the variance of productivity growth rates during the fifties according to Smolny's calculations.

[14] If we believe that West Germany was already pushed off its long-run growth trajectory by the First World War, and by the severe crisis of the 1930s, we might conclude that reconstruction growth takes a much more prominent role during the 1950s and 1960s.

[15] Calculated on the basis of Business Statistics Office (1978), table 1.

reconstruction is indeed an important factor in explaining the UK/German productivity race, it is only part of the explanation.

Table 3.7: Labour-productivity growth rates in West Germany and the United Kingdom, 1951 -1968

	West Germany				United Kingdom			
	1950-1955	1955-1960	1960-1965	1965-1970	1950-1955	1955-1960	1960-1965	1965-1970
Mining	3.95	6.27	7.35	10.56	-0.05	0.09	5.12	6.05
Food and Tobacco	5.30	6.48	6.79	5.53	0.70	5.40	2.82	3.81
Chemicals	6.84	8.40	9.51	13.48	3.74	6.56	6.63	9.53
Iron and Steel	5.09	4.91	3.55	8.48	3.61	1.43	2.79	1.32
Non-Ferrous Metals	7.46	6.76	4.79	7.89	0.31	1.83	2.61	3.91
Mechanical Engineering	3.59	4.05	4.00	1.35	0.89	2.19	3.77	4.79
Electrical Engineering	7.53	6.50	6.81	7.61	1.87	3.52	3.62	6.68
Transport Vehicles	10.93	8.45	6.12	4.67	6.71	6.17	4.97	5.42
Fabricated Metal Products	4.50	6.30	5.49	3.40	1.94	1.20	2.23	1.55
Textiles	5.86	8.99	7.77	7.19	1.36	3.00	4.58	9.30
Leather Industry	4.93	6.05	5.32	3.92	0.03	0.13	2.47	1.98
Clothing and Footwear	5.71	5.04	5.74	3.81	3.18	4.77	5.48	3.98
Building Materials	5.86	7.64	7.40	7.45	2.69	3.12	7.04	8.12
China and Earthenware	3.16	6.10	6.55	6.59	-0.43	2.59	4.07	6.54
Glass Industry	1.51	8.09	8.70	6.04	2.28	2.56	4.38	5.69
Lumber and Woodworking	5.17	8.21	7.63	6.40	2.89	2.13	2.12	-0.93
Paper, Printing, Publishing	3.99	5.85	5.68	6.36	2.69	3.85	3.37	2.62
Miscellaneous Industries	5.77	8.19	7.53	7.41	3.46	2.42	2.99	5.90

Source: own calculations based on data from the Statistisches Bundesamt (1973), '*Lange Reihen zur Wirtschaftentwicklung'*, pp. 74-75; Statistisches Bundesamt (1975), '*Industrie und Handwerk*', Fachserie D, Reihe 2, p. 7; various volumes of the Central Statistical Office's '*Annual Abstract of Statistics'*; Department of Employment and Productivity (1971), '*British Labour Statistics, Historical Abstract 1868-1968'*.

3.3.3 Post-war reconstruction and Britain's relative economic decline

Having established the relative productivity levels for British and West-German industry both before and shortly after World War II enables me to account for convergence and reconstruction growth in the comparative development of industrial labour productivity during the Golden Age. As I have argued, Britain's relative decline was to some extent unavoidable since it was due to West

Germany's larger potential for catch up growth. I use existing time-series evidence to extrapolate my new 1951 benchmark forward to 1958. I only extrapolate a few years since it is well known that extrapolating too far into time can lead to severe biases. However, by extrapolating in this way, it is possible to observe approximately when West Germany managed to surpass the British productivity level in a given industry and when West Germany recovered, if at all, to the relative position established in the mid-1930s. This exercise requires annual growth rates of gross-value added per man-hour worked at the industry level. For West Germany this data can be directly acquired from a collection published by the Federal Statistical Office on long-run time series.[16] The index numbers have been constructed on 1962 as the base year, and thus it required an additional source to establish industry shares in 1962 gross value added for the purpose of the reclassification.[17] For the United Kingdom, index numbers on valued-added in constant prices for total industry are reported annually from 1948 onward online by the Office for National Statistics.[18] However, this source was not sufficiently disaggregated for my purposes. For Britain, an industrial index of production is reported in the *Annual Abstract of Statistics*.[19] I built a consistent 1951-68 index-number series by using 1958 weights. Employment figures and index numbers on hours worked are drawn from the *British Labour Statistics, Historical Abstract 1868-1968*.[20] Using these data, I could construct an index on value added per hour worked for every year from 1951 to 1959.

I have managed to disaggregate my series into 18 industry groups that are closely matching the industry classification of my benchmark. I only needed to average up a few industries, especially under food and tobacco and the miscellaneous group, to make the 1951 benchmark perfectly compatible with the time series. The results of the computations are reported in Table 3.8. At the aggregate level and in almost all industries, German manufacturers caught up with their British rivals in labour productivity by the late 1950s. The shaded figures represent the point in time when West Germany had overtaken the United Kingdom in a given industry. The bordered rubrics indicate industries where the German lead was already established in 1951. Table 3.8 demonstrates that by 1960 the West-German productivity lead over Britain was indeed overwhelming in the

[16] Statistisches Bundesamt, *Lange Reihen*, pp. 74-75
[17] Fachserie D, Reihe 2 (1975), p. 7
[18] http://www.statistics.gov.uk/statbase
[19] Central Statistical Office, *Annual Abstract of Statistics* (1958, 1960, 1966, and 1976)
[20] Department of Employment and Productivity, *British Labour Statistics*, Tables 25-26, and Table 138

branches of large-scale industry, such as coal mining, iron and steel, non-ferrous metals, chemicals and textiles. By contrast, British manufacturers were performing relatively well in industries that traditionally included a vast army of highly specialised small and medium-sized firms, mechanical engineering and metal products, china and earthenware, or clothing and footwear. In electrical engineering and transport vehicles, labour-productivity levels in Britain fell behind more substantially, but were still not worse compared with the respective West-German levels than they had been in the mid-1930s. These findings are also largely in line with the finding of Smith et al. for 1968. As indicated in Table 2.7, West Germany was performing especially well in the chemical industry and the metal industry.

Table 3.8: Relative levels of industrial value added per hour worked in West Germany (UK = 100)

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Mining	88	91	94	97	103	107	112	122	131	140
Food and Tobacco	73	76	81	84	88	90	97	101	104	92
Chemicals	104	115	117	114	117	115	125	132	133	127
Iron and Steel	122	126	117	120	129	127	132	141	146	153
Non-Ferrous Metals	83	84	104	107	109	111	120	124	127	138
Mechanical Engineering	95	102	104	101	106	109	112	117	116	116
Electrical Engineering	83	90	90	97	103	106	109	111	109	119
Transport Vehicles	96	111	97	110	113	123	115	130	132	125
Fabricated Metal Products	45	46	49	48	49	51	53	56	62	63
Textiles	105	118	114	120	125	128	141	154	157	166
Leather Industry	91	97	98	102	110	119	131	134	142	147
Clothing and Footwear	89	89	94	99	98	96	102	103	99	99
Building Materials	67	70	72	73	76	79	87	94	95	94
China and Earthenware	79	81	82	87	91	105	103	103	103	108
Glass Industry	119	122	119	123	116	131	139	149	149	150
Lumber and Woodworking	100	104	105	99	109	119	126	135	135	146
Paper, Printing, Publishing	113	142	127	120	119	124	132	134	135	131
Miscellaneous Industries	78	74	74	74	75	83	89	93	99	99
Total Manufacturing	**84**	**91**	**90**	**91**	**94**	**97**	**101**	**106**	**108**	**109**

Notes: industries where West Germany productivity levels were above the British equivalents in 1951 are in bordered rubrics. Grey shades indicate the year when an industry caught up with its British counterpart in labour productivity. Electrical engineering includes optical and precision instruments.

Sources: own calculations, see text for the underlying sources.

Although the cross section is far too small to apply sophisticated econometric techniques, even a quick glance over the table reveals a clear pattern of convergence in the early 1950s, and a clear overtaking of Britain by West Germany in the second half of the 1950s. In coal mining, the engineering industries, and leather goods, where the initial productivity gap was smaller than for industry as a whole, West Germany had overtaken Britain in the first half of the 1950s. By contrast, in food and tobacco, china and earthenware, and in the miscellaneous industries (which include rubber and asbestos, jewellery, musical and sports equipment among others), German manufactures only managed to erase the relatively large initial gaps towards the end of the decade. In two industries where the West-German relative productivity level was the lowest in 1951, building materials and fabricated metal products, the British productivity lead survived for an extended period. In 1960 the United Kingdom still had the lead in a few industries, namely food and tobacco, fabricated metal products, clothing and footwear, miscellaneous and building materials. Although, except for fabricated metal products, this lead was small. Near the end of the Golden Age in 1968 West Germany was still behind Britain in some of the industrial branches within the fabricated metal products industry.[21]

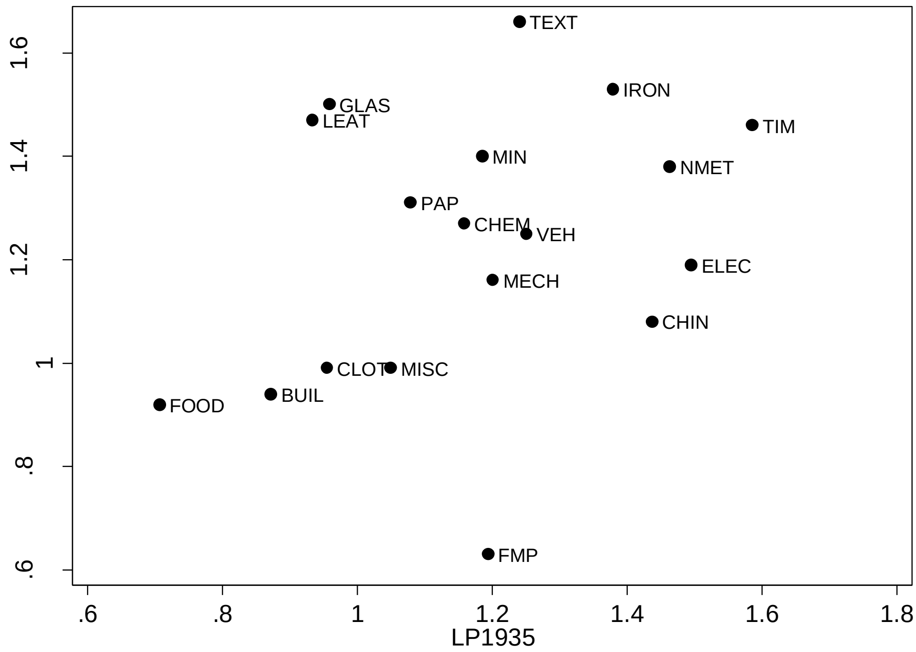
From the perspective of my motivation, the most important finding is that while West Germany had overtaken the United Kingdom in industrial labour productivity in the late 1950s, it was not before the beginning of the 1960s that West-German manufacturers managed to re-establish the relative productivity position they had attained by the mid-1930s.[22] At the aggregate level, Britain's relative decline in industrial productivity in the course of the German *Wirtschaftswunder* can be attributed to the post-war reconstruction dynamic and not to failure per se. The disaggregated figures enable me to test this postulation in a cross section of industries. The scatter diagram in Figure 3.2 plots the projected levels of labour productivity in West Germany in 1960 relative to Britain against the benchmark estimates for 1935. This analysis is similar to the analysis in Section 2.6. There I was able to show a large continuity in relative labour-

[21] According to labour-productivity estimates of Smith, Hitchens and Davies (1982, pp. 122-124) West Germany is more than 20 per cent behind Britain in cutlery and tableware.[21] It must be noted however, that the method Smith et al. used to construct their labour productivity estimates deviate from the method I apply, and therefore I cannot directly compare results. For more information see Section 2.6 in Chapter 2.

[22] I found that the gap for the mid-1930s was 115 (GE/UK). If I extrapolate my labour-productivity estimate for 1951 further, I find that at the aggregate manufacturing level in 1962 Germany is at 117 per cent of the British level.

productivity levels between West Germany and the United Kingdom over the period 1935-1968. The estimate for 1968 from Smith et al. was not directly comparable to my own data set, hence I could not use the full sample size. In this analysis I am interested in the continuity over labour-productivity gaps over a shorter period, to evaluate to what extent German reconstruction played a role in the German *Wirtschaftswunder*.

Figure 3.2: Relative levels of labour-productivity in West-German industry (UK = 1)



Sources: my own labour-productivity estimates for 1935 (see Table 2.4) and the extrapolation from Table 3.8.

We can observe a very strong positive relationship for most industries, with only a few outliers. West Germany reported very low relative productivity levels in fabricated metal products, where it actually commanded a respectable lead in the 1930s. The main reason for this shift is most likely the changing composition of the product mix. In the interwar statistics, small firearms, hand grenades, and simple tools used for military consumption were all included under this industry. The production of armaments was shut down by the Allies after 1945 and was only re-allowed following the German accession to NATO in 1955 – most notably after the Sputnik shock in 1957. Consequently, until the late 1950s, the industry operated without the relatively large-scale and highly capital-intensive plants that used to supply these products in 1935.

In contrast, in the leather and glass industries, West Germany recorded much higher levels of labour productivity relative to Britain in the post-war period than in 1935. Depressed consumer demand during the 1930s together with the prioritisation of first public works and later war reparations implied that light manufacturing received very little investment. This changed markedly thanks to the consumer boom of the early post-war decades. These industries became increasingly capital intensive particularly from the late 1950s onward. West Germany was entering an extended period of critical labour shortage, with the unemployment rate averaging one per cent between 1959 and 1972. Under these conditions, the industries that typically paid the lowest wages tried to increase output with fewer employees. This called for the substitution of capital for skilled labour, which was in particularly short supply as the number of industrial apprentices began to plummet already in 1956 (Hoffmann 1962). In the early 1960s, the number of manual workers also began to decline sharply in textiles, the timber industry and woodworking, yielding higher levels of capital intensity and, thus of labour productivity.

For all 18 industry groups, I obtain a coefficient of correlation of 0.33 between the 1935 benchmark and the projected levels for 1960, which is not significant at the ten per cent level. If I eliminate fabricated metal products, which is a clear outlier, the coefficient jumps to 0.41 and turns significant at the ten per cent level.[23] Given the small number of observations, this is a statistically very robust finding, which backs the argument that West-German super-growth until the early 1960s was partly driven by post-war reconstruction.

3.3.4 The implications of the new findings for the debate on Britain's failure

The aim of this dissertation is to contribute to the long debate on Britain's relative economic decline during the Golden Age of economic growth. The new data set I constructed, and the analysis performed with this new data allow me to discuss this important debate on British economic history, which is still very much alive. My new findings shed more light on the big questions concerning the economic performance of Britain, and I am able to demonstrate that some

[23] When the glass industry and the leather industry are also excluded from the sample the coefficients of correlation increases even further to 0.62, which is statistically significant at the 1.6 per cent significance level.

arguments used in the literature should be rethought. My conclusion on the timing of the West-German overtaking of the British productivity level are different from what previously has been argued in the literature. This is best explained by reviewing an important discussion on the 'Manufacturing Failure Hypothesis' which has been held in 2003 in the '*Economic History Review'* between Booth (2003a) and Broadberry and Crafts (2003). Booth claims that Britain was actually performing much better during the long-boom than supposed in the literature. He claims that two-third of the total relative improvement of German manufacturing productivity during the period 1950 to 1973 had been secured by 1952. He uses data from Broadberry's (1997) 'Productivity Race' to reach this conclusion. In Broadberry's data (1997, pp. 49-50) Germany is at 96 per cent of the British productivity level by 1950, at 111.2 per cent of the British level by 1952 and at 118.6 per cent by 1973. This indeed implies that 67 per cent of Germany's improvement in relative productivity was secured by 1952. In their reply, Broadberry and Crafts (2003) argue that it is of crucial importance to take business cycle peaks as end point in calculating trends in growth rates. This dispute of dates is of crucial importance, since it heavily influences the conclusion that will be drawn on the basis of the data. Also important in this respect is that from 1952 till 1959 the German productivity level as compared with the British never exceeds 111.5. During some years the productivity level of West Germany as compared to Britain also decreased and fell below this 111.5 level. Thus, if we focus on the 1960s only, the average annual growth rate will be much larger than the growth rate that Booth calculated for the whole period.

Broadberry's estimate for 1950 is not based on a benchmark constructed for that year, but it is based on an extrapolation. As I have demonstrated in Chapter 2, there can be large distortions in extrapolations. Broadberry's work does not take hours worked into account. According to Broadberry (1997) taking hours into account would make no substantial change, since working hours have moved in a broadly similar way. Although this is to some extent true for 1935, I managed to demonstrate that there is a large difference in the actual hours worked for Britain and West Germany in the post-war period, and this highly influences the results.

I have reworked the existing labour-productivity estimates of Fremdling et al. to include only West Germany, and I find that West Germany was 11 per cent ahead in manufacturing labour-productivity as compared with Britain in 1935. When I use my new data, I come to a different conclusion with respect to the part of relative labour productivity gain that West Germany secured in the early 1950s.

Table 3.9 presents the comparative labour-productivity estimate in manufacturing for the period 1951 to 1968.

My estimate for 1968 is the same as the 1968 based labour-productivity estimate of Smith et al. (1982, p.124). They also arrive at a labour-productivity level of 123 for West Germany, albeit they use a different method. When I measure labour-productivity as value added per hour worked, I find that West Germany is at 79 per cent of the British level in 1950. When I extrapolate this finding, I conclude that West Germany was at 123 per cent of the British productivity level by 1968. By 1952 less than one-quarter of this productivity advance was secured. This means that the period after 1952 is of crucial importance for the other three-quarters of productivity improvement that West Germany secured by the end of the 1960s. This conclusion deviates substantially from the conclusion Booth draws. More importantly, the claim that Booth makes focusses only at aggregate manufacturing while I strongly believe that any discussion on failure of British manufacturing should focus at the disaggregate industry level. My estimates make clear that there is a substantial increase in the relative productivity position of West Germany in the 1960s.

Table 3.9: Comparative labour productivity in industry West Germany/United Kingdom, 1951-1968 (UK = 100)

year	value added per hour worked
1950	0.79
1951	0.83
1952	0.89
1953	0.88
1954	0.89
1955	0.92
1956	0.95
1957	0.99
1958	1.04
1959	1.06
1960	1.06
1961	1.09
1962	1.14
1963	1.15
1964	1.17
1965	1.19
1966	1.22
1967	1.23
1968	1.23

Sources: see Table 3.8.

The data presented in Table 3.6 reveal large differences in the growth rates and in the difference between growth rates in West Germany and the United Kingdom across industries. I see that the average annual growth rates in labour-productivity of West Germany were indeed high in the first half of the 1950s, while in Britain growth rates were very low, or even negative. In the second half of the 1950s Britain also experiences higher growth, but West Germany was able to more than match these growth rates. Importantly, after West Germany caught up to the British levels of labour-productivity in the late 1950s, it still witnessed much higher growth rates than Britain. Most important in this respect are the large differences across industries. Especially in chemicals, non-ferrous metals, lumber and woodworking and paper and printing the West-German growth rate is substantially higher in the second half of the 1960s.

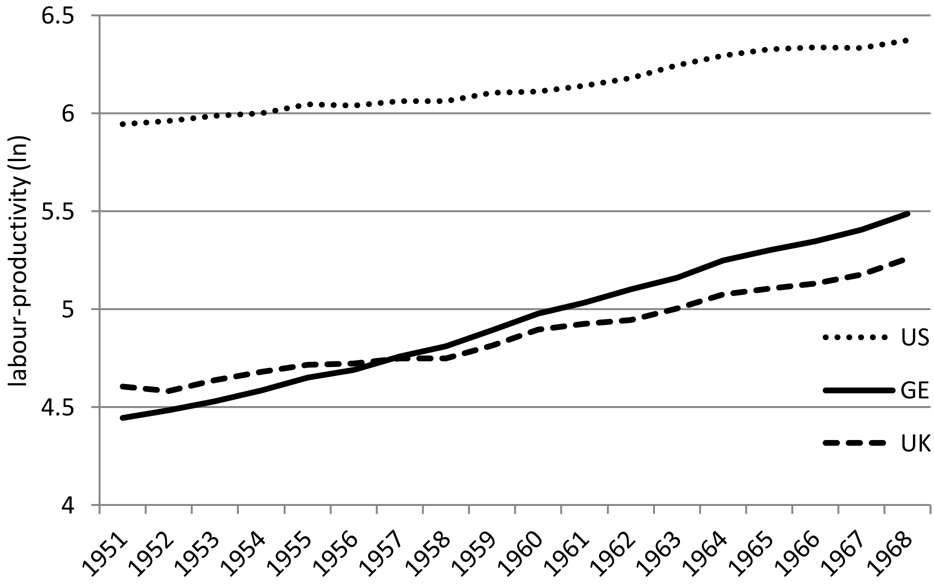
If in any period during the Golden Age, British industry was failing in comparison with West Germany it must have been during the 1960s, and not so much in the 1950s. After 1961 the growth of value added per hour worked in total manufacturing was still more than 1 percentage point faster in West Germany than in the United Kingdom. Thus, during the 1960s the West-German productivity level increased substantially as compared with the UK. Therefore, I believe that the Broadberry-Crafts view on failure in the manufacturing sector should focus more specific on the second part of the Golden Age, since in the first decade we can hardly speak of failure, given the underlying economic conditions and Germany's scope for catch-up and reconstruction. In the next section I will discuss the underlying causes of British failure.

3.4 Underlying causes for British failure

The previous comparisons have all focused solely on Britain and West Germany. In this section, I will introduce the United States, which was the world's most productive nation in virtually all manufacturing industries, and undoubtedly the productivity leader during the Golden Age.[24] Therefore, the United States represents the actual technology frontier and West Germany and Britain, like other industrial nations, were converging to. I use an existing US/UK labour-productivity benchmark of Paige and Bombach (1959, p.33) for 1951 and data from the GGDC 10-sector database for value added and total hours worked to construct a productivity index for United States manufacturing in the period 1951-68 (Van Ark 1996). Figure 3.3 shows how German and British industry converged towards the technological frontier during the post-war Golden Age. Whereas the American productivity lead over Britain remained relatively constant, it became significantly more moderate in relation with West Germany, even though it did remain substantial. The US/UK labour-productivity benchmark dropped from 3.87 in 1951 to 3.44 in 1968. The indirectly constructed US/West Germany benchmark moved from 4.55 to 2.7 between the two years. West Germany seemed to be much more successful in catching up to the US.

[24] See Nelson and Wright 1992 among others.

Figure 3.3: Labour productivity in US, UK and German industry (natural logs)



Sources: own calculations, see text for the underlying sources.

The diagram demonstrates two important findings. First, West Germany was gradually catching up with the United Kingdom until the 1958 recession, after which the two countries moved together in terms of productivity growth until 1961. In the mid-1960s, however, West-German industry managed to pull away from its British counterpart. Secondly, this forging ahead followed a significant acceleration in American productivity growth. One of the reasons to introduce America in the picture is the important claim in the literature that Britain failed in so-called Americanisation of manufacturing production. The next section will investigate this issue in detail.

3.4.1 British failure in Americanisation and mass production techniques

In this section, I focus on the adoption or the lack of adoption of American models of production and mass production techniques. In the literature on Britain's relative economic decline the lack of adopting mass production techniques is often seen as one of the main reasons of relatively poor performance in an international comparison. I will focus on both technological reasons and institutional reasons which may have affected the decision to adopt mass production techniques.

The American model usually refers to a system of mass production, in which standardised products are produced in large plants with special-purpose machinery, with mainly unskilled labour, and systematic management techniques and hierarchical structures (Zeitlin 2004). The extent to which countries can adopt this system of production is dependent upon factor and resource endowments, and the demand pattern. In the nineteenth century the United States was equipped with cheap resources, and skilled labour was scarce, combined with a homogeneous demand pattern. This allowed for a wider adoption of mass production techniques than in Europe (Ames and Rosenberg 1968; Broadberry 2004).[25] Even though Britain was not adopting mass production techniques at the same speed as the United States and relied on craft based production, it is well agreed upon in the literature that in terms of technology Britain was the leading manufacturing nation in the first part of the nineteenth century (Broadberry 1994). However, this position was gradually overtaken by the United States in the second half of the century.

The view that Britain failed in mass production is not limited to the post-war period. According to Harley (1974 p. 414) in the Edwardian period there '*is no question that British industry was slow in adopting new techniques that were adopted elsewhere and that were probably also technically, if not economically, more efficient*'. According to Chandler (1992) the problem in British manufacturing already started at the end of the nineteenth century. As an example he mentions the synthetic dye industry, a sub-industry in the chemical sector, were the British entrepreneurs were pioneers. The first person to invent synthetic dyes was British. Until after the Second World War the largest market for these dyes was the British textile industry. Since dyes are made from coal, and Britain had the largest supply of high quality coal in the world, it should be expected that Britain would dominate the world dye market. However, according to Chandler British entrepreneurs failed to make the necessary investments in production, distribution and management whereas German competitors did. Chandler argues that failure in the development of organisational capacities is the underlying problem in many manufacturing industries. For the early 1970s Prais (1981) argues that Britain failed in especially those industries that require a very large-scale of production. Davies and Caves (1987) conclude for the end of the 1960s and 1970s also that Britain's plants failed especially in industries with large scale economies.

In the Broadberry-Crafts view (2003), Britain's inability to adopt American mass production techniques is seen as an important reason for its slow performance in labour-productivity growth. Booth (2003a) criticises the

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[25] Although Allen (2013) comes to another conclusion, and argues that the differences between the United Kingdom and the United States are small when viewed in a global context.

Manufacturing Failure Hypothesis for having fundamental flaws, where his critique is focused on the premise that Britain was failing in large plants, and on the distinction between Fordism in the US, and specialised batch-production in the UK. The British production system is usually viewed as operating on a smaller scale than the United States system. Many firms were family owned. The United Kingdom is supposed to be specialised in batch-production, and usually a family-member takes the role as manager. However, Booth warns that this distinction might be too crude. Although America was using mass-production techniques, not all manufacturing output was produced in large plants. Therefore, classifying the United States as 'Fordist' is not a very sensible classification according to Booth.

There is also good economic reason not to adopt mass production. As compared with the United States Britain experienced greater inequality in the distribution of income and wealth, combined with a class distinction, which means that standardisation was not accepted (Frankel 1957). As Crafts (1994) writes '*investigation of decisions made by entrepreneurs and by investors in capital markets has refuted some of the wilder charges or irrationality and incompetence which used to be commonplace explanations of an over commitment by late Victorian/Edwardian Britain to old methods and an outdated industrial structure*', (p 39). Zeitlin (2004) notes that British manufacturers of components saw more possibilities for a reduction in production variety, than manufacturers of consumer goods and capital equipment. The most aspiring projects to experiment with mass production and standardisation were actually undertaken by nationalised enterprises, for example the railways and the electricity supply (Zeitlin 2004).

After the Second World War, there seemed to be interest from the United Kingdom in American production techniques. An important question is whether there were any effects from the United States on British corporations to enhance productivity. The most frequently mentioned example of such initiative is the Anglo-American Council of Productivity (AACP), which was formed during the autumn of 1948.[26] This council consisted of representatives of management and labour both in Britain and in the United States.[27] The aim of the AACP was '*to promote economic well-being by a free exchange of knowledge in the realm of industrial organization, method and technique, and thereby to assist British*

[26] See '*The final report of the Anglo-American council on productivity*'. The AACP was part of the Marshall plan. The congress of the United States declared it to be American policy to promote industrial and agricultural production and increase productivity in European countries (AACP final report, p. 5).

[27] The constituent bodies in the United Kingdom were: the Federation of British Industries, the British Employers' Confederation and the Trades Union Congress.

industry to raise the level of its productivity'.[28] The method to achieve this goal was to send American industrial teams to Britain. These teams consisted of a mixture of members from supervisory levels, technical personnel, and workshop personal. The Council was operating until June 1952, which was the end of the Marshall aid period. The Council continued as the British Productivity Council after this period.[29]

In the literature scholars have been pessimistic about the achievements of the AACP.[30] Tomlinson (1991) discussed the reasons for failure of the productivity enhancing initiative. He mentions as one of the most important reasons that the period in which the AACP operated had a particular economic climate, with a sellers-market. This implies that there was little incentive for employers to revolutionise their practices, since profits were high anyway. Carew (1987; 1991), in his critique on the AACP, focuses mainly on the tendency of the reports to emphasise the intangible causes of the productivity difference between the United States and the UK. Some of the reports of the AACP would literally state that Americans were found to be 'production-minded' and that attitude derived from a 'climate of productivity' (Carew 1991). These types of findings do not yield any suggestion for changes that could be implemented in the British manufacturing industry.

Due to the historical commitment to craft production in Britain, attempts to switch to American mass-production methods were resisted by skilled shop floor workers whose job became threatened (Broadberry & Wagner 1996). In many sectors, this became a more serious problem as markets and possibilities for technology transfer changed in the early post-war period. Another effect of the success of the unions was that in many industries they could defend custom and practise in working habits, even when new technologies were introduced (Williams, Williams and Thomas 1983). According to Williams et al. (1983) this resulted in machines, installations and assembly lines that became over-manned, were run slowly and poorly used.

British managers were also not very eager to adopt the American mass-production technologies since they were not used to exercising the degree of shop floor control needed to make it profitable (Lewchuk 1987). Part of the reason might be that in Britain managers were rarely recruited on the basis of educational attainment, selection in management positions was the result of on-job experience

[28] See '*The final report of the Anglo-American council on productivity*', p. i.
[29] The BPC started in 1953, the aim of this permanent organisation was to promote awareness of productivity and to follow up on the recommendations done in the reports of the AACP.
[30] See e.g. Tomlinson and Tiratsoo 2002.

(Tuckman 1996,). In crafts industries such as for example the printing industry, labour unions were resisting the introduction of new equipment and reorganisations (Eichengreen 2006, p. 124). But also in the motor vehicle industry, workers managed to impose restrictions on the introduction of mass production techniques (Eichengreen 2006).

Interestingly, US management consultancies had a relative limited impact in Britain and West Germany in the early post-war period (Zeitlin 2004). There came a role for US management consultancy firms, notably McKinsey&Co in transferring the multidivisional form of corporate organisation to large British firms in the 1960s. However, the introduction was not without problems, quite often the multidivisional structure was implemented in an incomplete or modified form. In West Germany the important industries such as the steel industry, engineering industry, automobile industry never adopted the M-form at all, and they kept the traditional holding company structure till the 1970s (Zeitlin 2004). Important in this aspect is also investment in capital. If we assume that Britain is transferring to mass production techniques, we should witness an increase in capital investment, as mass production techniques are more capital intensive than the traditional crafts based techniques. In the period 1924 to 1937, the capital stock in Britain grew very slowly, at only 1 per cent per annum (Crafts 1994, p. 39). Hence, there was not much capital deepening going on before the Second World War. Especially in engineering managers opted for methods less capital intensive than in the US, which meant more job control by the strong craft unions (Crafts 1994). In the next section I will discuss the large plant problem in more detail.

3.4.2 The large plant problem in Britain

This section attempts to provide more quantitative evidence on the productivity levels of firms with a different scale. To assess to what extent there was a problem in large-scale manufacturing in Britain Booth constructed so-called ‘footprints’ of British and American manufacturing productivity for 1954. These footprints show net output per employee for establishments of different sizes (Booth 2003a).[31] Table 3.10 below reports his results.

[31] In the British data the establishment size reported in the census varies over time. Booth therefore made guesstimates to obtain information on the same establishment size groups as provided in the US census of manufactures.

Table 3.10: Manufacturing footprints, US and UK, 1954 and 1967-1968

1954	*Size of establishments (number of employees)*						
	10-49	*50-99*	*100-499*	*500-999*	*1000-2499*	*2500+*	*All*
UK relative productivity	85	89	96	105	111	110	100
% total net output	9	9	32	14	17	19	
US relative productivity	82	87	96	105	113	112	101
% total net output	11	9	29	14	17	21	
US 1967	*10-49*	*50-99*	*100-499*	*500-999*	*1000-2499*	*2500+*	*All*
US relative productivity	86	85	92	103	115	118	100
% total net output	12	8	29	13	15	23	
UK 1968	*10-49*	*50-99*	*100-499*	*500-999*	*1000-1999*	*2000+*	*All*
UK relative productivity	88	83	91	105	112	116	100
% total net output	11	7	28	15	15	24	15

Source: Booth (2003a), Table 5, p. 16.

In 1954 for example, British establishments with 10-49 employees were at 85 per cent of the productivity level in total British manufacturing. US establishments in this size class were at 82 per cent of the US productivity level in total manufacturing. Thus, for both countries, these small establishments were less productive than average.

Booth concludes that the distribution of total value added and the productivity measure are very similar in the United Kingdom and the United States for the year 1954 and 1968. He indeed finds that the United States has larger establishments in the largest size class, however, only a small percentage of the total labour force is employed in this category. Probably the most interesting result of his comparison is that the productivity gap in establishments with less than 100 employees is of the same dimension as the gap in establishments employing more than 2500 employees. Especially for the small establishments it is expected that scale, multidivisional organisation, and deep managerial hierarchies are not very relevant (Booth 2003a, p.17). Table 3.10 also reveals that in the United States only a bit more than 20 per cent of net output was produced in establishments with more than 2500 employees. Roughly half of the production was produced in establishments with less than 500 employees. This pattern is very similar for Britain. Hence, Booth's conclusion is that there was no large plant effect at work.

Although Booth makes a good attempt by comparing productivity in manufacturing plants of different sizes in Britain and the US, there is not too much sense in doing this only at the aggregate level. As I have argued before, failure will be industry specific, and hence, any endeavour to reveal failure should take place at the disaggregated industry level. One major problem with aggregating is that in terms of employment, what is large for one industrial branch can be small for another. Different industries work with different production functions. For example, in 1951 in Britain the largest plants in engineering, shipbuilding and electrical goods employed more than 10.000 persons, whereas the largest firms in the leather industry employed less than 1000 persons. Obviously, in some industries there are larger economies of scale than in others. Therefore, simply grouping all industries together will not capture all the industry dynamics. However, the information at the aggregate level does reveal whether there is an increase in scale over time. Table 3.11 reports for total manufacturing the percentage of net output produced, and percentage of the total labour force employed, and the relative productivity level in different establishments size groups, for the period 1930 till 1970. By 1970 more than 43 per cent of net output is produced in establishments with more than thousand employees, and more than 40 per cent of all employees in manufacturing is employed in such establishments. When we compare 1951 with 1970, we see that there has been a steady increase in the amount of net output produced in the largest establishments, whereas there is a decrease in the smaller establishments. There has been a decrease in the percentage of employees employed in establishments with less than 500 workers. The average size of the largest establishments increased from 2225 in 1951 to 2647 by 1970. There is a clear increase in the scale of production in the period 1930-1970. This is partly the result of an increase in the number of establishments in this size group, and partly the result of an increase in the size of establishments in this size group. Interestingly enough, however, the productivity level of the largest size group does not change much from 1951 to 1970. If mass production techniques led to higher productivity, we would expect to see an increase in productivity over time.

Table 3.11: Net output and employment distribution over different establishment sizes for total manufacturing in the United Kingdom

	1-24	25-99	100-500	500-999	1000+
	Percentage of net output produced by different establishment sizes				
1930	12.26	15.45	30.65	41.65	
1935	12.09	16.69	32.92	38.30	
1948	9.41	16.92	32.63	13.63	27.39
1951	7.38	15.32	32.58	13.79	30.92
1954	7.57	13.71	30.89	13.66	34.18
1963	7.13	10.51	28.56	14.84	38.96
1968	7.80	10.29	28.45	15.13	38.33
1970	a	16.36	25.74	14.37	43.53
	Percentage of total employment employed by different establishment sizes				
	1-24	25-99	100-500	500-999	1000+
1930	12.80	16.10	32.68	38.44	b
1935	12.53	17.63	35.36	34.49	b
1948	9.89	16.95	32.22	13.49	27.46
1951	8.41	16.80	32.64	13.21	28.94
1954	8.36	15.71	32.39	13.14	30.42
1963	8.01	12.19	30.67	14.24	34.90
1968	8.45	11.82	30.65	14.55	34.53
1970	7.34	11.10	27.03	13.89	40.63
Productivity level (net output per employee) based on size of establishments (average productivity = 100)					
	1-24	25-99	100-500	500-999	1000+
1930	96	96	94	108	n.a.
1935	96	95	93	111	n.a.
1948	95	100	101	101	100
1951	88	91	100	104	107
1954	91	87	95	104	112
1963	89	86	93	104	112
1968	92	87	93	104	111
1970	n.a.	147	95	103	107

Note a: for this size group the information is presented in the next higher size range. b: for this size group the information is presented in the next lower size range.

Source: own calculations based on Business Statistics Office (1978), '*Historical Record of the Census of Production 1907-1970'*, Table 7 pp. 244-245.

In an attempt to partially solve the problem with aggregate footprints I constructed disaggregate 'footprints' for 1935, 1951 and 1971 for the UK. The production censuses of the United Kingdom provide information on the number of employees per establishment, and the output generated there. Per size-group I calculated labour productivity per employee based on value added per employee; the percentage of total employment employed in these firms; and the percentage of total output and value added of the industry produced by this type of firms. Unfortunately the sizes of establishments distinguished by the censuses are not the same for all industries and not the same for all years. To keep as much information as possible I stick to the classification as given in the respective years, Table A-2.1, A-2.2 and A2.3 in the Appendix present the results, where I have set the average labour productivity of each industry in each year on 100. The relative productivity of establishments of a certain size type differs remarkably over industries.

To assess whether there is a problem with Britain's performance in large-scale manufacturing I need to define clearly what I mean by failure in large-scale operations. A clear example of failure in large-scale operations would be if large firms which produce a similar product as small firms were less productive. But even if the large plant was as productive as a small plant, we could consider this as failure, since we would assume that a large plant can benefit from economies of scale, and hence productivity should be higher. Failure in large-scale operations does not only mean failure in the sense of relative low-productivity in existing large plants, but also failure to set up these high productive large plants. Even if we find that large-scale production is more productive than small-scale production, we do not know how much larger production in these large-scale establishments could have been, under more efficient production, which can still hint at failure. Thus, we should be careful in interpreting the result.

A major difficulty in this analysis is to judge whether the production mix of different plants will be the same. Part of the reason for differences in productivity might simply be that the output produced is different and more, or less labour intensive. In some industries, such as in the engineering, shipbuilding and electrical goods industry for example, we can assume that the products produced in the establishments with 11-24 employees is of a different nature than the products produced in those firms with more than 10,000 employees. When we examine the ratio of net output to gross output for 1951 in Table A-2.1 in the Appendix, we observe that there is a difference between the size groups. Since net output is obtained after deducting from gross output the costs of materials and fuel used, and the amount paid to for work given out and other payments recorded in the census, this can be the result of a different input-output structure.[32] For example, if a large establishment can buy its inputs more cheaply, this will lead to a higher net to gross output ratio. Similarly, it can be the result of simply producing a different type of product, which requires more or less inputs, or inputs of a different quality. When we assess wages we see that these are in general higher in the larger establishments. This makes sense if we believe that more value is added in these firms, and labour is paid its marginal product.[33]

Productivity is for some industries higher than average in the large establishments, and for some lower. Table 3.12 below shows the footprints for textiles and chemicals.[34]

Table 3.12: Manufacturing footprints for textiles and chemicals (>1500 employees)

	nr. establishments	Total nr. employees ('000s)	Share in employment	Productivity (average = 100)
		Textiles		
1935	33	83.6	7.92	121
1951	38	90.1	9.74	138
1970	44	134.8	22.01	127
		Chemicals		
1935	12	38	19.67	100
1951	29	93.7	24.96	89
1970	56	175.8	42.66	109

Sources: own calculations based on Board of Trade (1938-1944), '*Final Report of the Fifth Census of Production and the Import Duties Act Inquiry 1935*'; Board of Trade (1954) '*The report on the census of Production for 1951*'; Business Statistics Office (1976), '*Report on the census of production – summary tables*'.

In textiles for example the establishments with more than 1500 employees were 1.38 times as productive as the average in the industry in 1951. In 1935 the largest establishments in the textile industry were also more productive than average, but the differences in productivity between the size classes were much smaller than in 1951. By 1971 establishments with more than 1500 employees were responsible for 22 per cent of total employment, whereas this share was less than ten per cent in 1951, and less than 8 per cent in 1935. Thus, there has been a clear shift towards

[32] Business Statistics Office (1978), 'Historical Record of the Census of Production 1907 to 1970', p. xiv.
[33] The coefficient of correlation between the wage and relative productivity is 0.40 for 1951 and it is statistically significant even at the 1 per cent level.
[34] This is a subset of the information provided in Tables A-2.1, A-2.2 and A-2.3 in the Appendix.

larger scale operations, which hints at a transfer to mass production and Americanisation.

In the chemicals industry the largest establishments, with more than 1500 employees, are as productive as the average in that industry in 1935. By 1951 the largest establishments are less productive, but by 1971 the establishments with more than 1500 employees are nine per cent above the average labour-productivity level of the industry. Whereas there were only 12 establishments with more than 1500 employees in 1935, employing around 20 per cent of all employees in this sector, this number increased to 29 by 1951, when 25 per cent of all employees in the sector are employed in this type of establishment. By 1971 there are 56 of these large establishments, employing more than 40 per cent of all employment in this industry.

American investment in the form of Foreign Direct Investment (FDI) could have been an important source of Americanisation. However, until the early 1950s American FDI was of minor importance in Europe, except for the oil and car industry, where in particular GM was a big party (Schröter 2005, p.63). Dunning (1958) hypothesised that if the superiority in US productivity was solely the result of better management, US manufacturing affiliated in Britain should perform as well as their parent companies, and much better than firms from British origin. His results indicated that indeed the American affiliates were more productive than British companies, but not as productive as American companies in the US.

Overall, I conclude that there is an increase in scale in British manufacturing over the course of the period under investigation. However, given Britain's specific situation, manufacturing was much less suited for mass production techniques and Americanisation than the United States was. Hence, it is not very surprising that these techniques were not implemented in the same form as the US. And one should wonder whether we should talk about failure, where there are clear economic reasons not to adopt a different production mode.

Although my calculations of labour-productivity levels in Chapter 2 did not focus on establishments with ten or fewer employees, i.e. the very small plants, it is interesting to evaluate the trend of these establishments as well. In 1930 Britain had over 93,000 establishments with less than ten employees and by 1960 only 35,000 such establishments existed and by 1970 it was it a bit more (see Table A-2.3 in the Appendix). By 1970 the share of employment in small firms (less than 200 employees) was less than 30 per cent (see Table A-2.3 in the Appendix) and approximately similar to the share in West Germany (Bannock 1981). Other advanced nations all employed larger shares of employment in small firms. Hence, I must conclude that Britain was, compared with nations other than West Germany, further ahead in the process of large-scale operations.

Although we usually assume that it is up to entrepreneurs to set up and run a business, there are some cases were the government is involved in deciding on the size of a business. A good example of how this government interference resulted in plants of a smaller size than necessary is the fourth steel mill in Britain. When the government planned to invest in steelmaking, they could choose for a modern and large plant at Newport, however, they decided to split the investment and construct two smaller and less efficient plants (Lee 1996, p. 38). The reason was the interest of employees and the regions where the facilities were located.

The data I have used here have revealed that in many cases the large plants were more productive than average. In that sense I can agree with the conclusion from Booth (2003a), who argued that there is not really any failure in large-scale operations.

3.4.3 The role of human capital

According to Oulton (1995) education is an important institution that was responsible for holding back British productivity growth in the post-war period. His argument is that too much effort of the British schooling system was focused on selecting and training the elite, instead of training the whole population. The critique that the British education system focuses too much on academic education, rather than practical education, and thus did not prepare pupils for the type of job they will carry out during their adult live, is not limited to the post-war period. For example, the growing technical superiority of Germany during the nineteenth century in chemicals, iron and steel and dyes has been attributed to the fact that Germany developed an extensive system of both university and polytechnic education with close ties to industry, whereas Britain focused much more on empirical methods and incremental tinkering to strive for improvements and adaptation (Vejarano and Ramírez 2002).[35]

Even as late as 1975 still 70 per cent of the population (aged 16-69) had no educational or vocational qualifications other than having attended school for the prescribed period (Oulton 1995, p. 61).[36] Since the end of the Second World War, Britain had suffered a chronic shortage of skilled craftsmen. Part of the reason that Britain’s ability to compete with other industrialised countries declined derived

[35] Adam Smith complained that education did not match with the requirements for jobs in the end of the eighteenth century (Prais 1993).
[36] The school leaving age in Britain was 15, and changed to 16 in 1972.

from Britain's failure to build and maintain a more skilled workforce (Dintenfass 1992, p. 38).

The Americanisation of industry required not only physical capital. Skill endowments in the industrial workforce had to be restructured as well. Craft-based production techniques prevalent in most branches of European manufacturing until the early post-war years relied heavily on the use of skilled manual labour. By contrast, large-scale serial production not only substituted capital for skilled labour, but also employed a large number of highly skilled technical personnel, production engineers and technicians. Prais (1993) criticises the British education system for not preparing students for jobs in manufacturing. Employees who are working with machinery on the shop floor usually do not have knowledge to maintain the machines. In West Germany, on the other hand, employees working with machines could also maintain machinery, which led to less stoppages and a more efficient production process (Prais 1993).

When we want to compare the West-German skill level with the British level an obvious proxy would be years of formal education experience of the population aged 15-64. However, this is an imperfect proxy, since the schooling systems of West Germany and the United Kingdom differed substantially. Moreover, during the 1950s and 1960s apprenticeship training remained the main formal method of skill formation for manual labourers (Gospel 1995, pp. 34-35; Prais 1988; Tuckman 1996, p. 135,).

I do not have data to compare the composition of industrial employment according to qualification levels in the two countries over the whole period. However, I have enough evidence to show that the West-German training system proved to be flexible enough to facilitate this technological transition. The number of apprentices in industry and handcrafts declined by twenty per cent between 1956 and 1960, despite the significant expansion of manufacturing employment (Hoffmann 1962, p. 112). By contrast, total enrolment in engineering schools increased by 62 per cent between 1958 and 1968, even though employment growth was much more modest than during the 1950s (Kultusministerkonferenz 1969).

In Britain the decline in apprenticeships was even larger than in West Germany (Broadberry and Wagner 1996). According to Broadberry and Wagner (1996) we can interpret this decline in apprenticeships as a signal that both countries tried to introduce Americanisation. The fact that the decline was much larger in Britain as compared to West Germany is an indication of the greater enthusiasm in Britain for Americanisation. An important element of Americanisation is larger control by managers. Broadberry and Wagner (1996) were able to show that the educational attainments of British and West-German managers were roughly on par. Hence, as Broadberry and Crafts (1996) argue, the relatively poor performance of Britain in American production techniques cannot be explained by the educational attainments of the management level. The view in the literature on amateurism in British managements seems highly overdrawn.

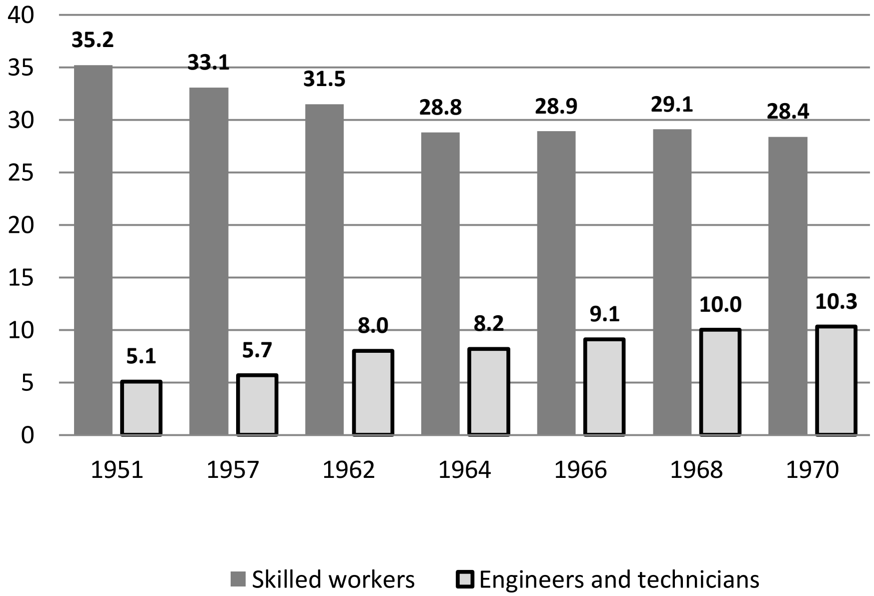
Figure 3.4 shows how the skilled labour endowments of West Germany industry had evolved over the 1950s and 1960s. From 1962 onward, the national employment and social statistics report detailed data on the composition of industrial employment, based on which I compute the share of both skilled manual workers, and engineers and technicians in total employment. For the 1950s, such figures are not available. However, the Federal Statistical Office conducted two large representative surveys on the structure of industrial wages and salaries in November 1951 and in October 1957.[37] From these sources, I can determine the ratio of skilled workers to the manual workforce and the ratio of technical personnel to all salaried employees represented in the survey. The industry statistics report employment broken down to salaried staff and wage labour.[38] Therefore, I can use these data to compute the share of both skilled manual workers and engineers and technicians in total employment. Figure 3.2 depicts a marked shift towards a more intensive use of highly skilled technical personnel and a parallel decline in the application of skilled manual labour between the late 1950s and the early 1960s.

To the extent that this trend was not matched by, or was less dynamic in, British industry, it provides an additional explanation for the superior German productivity performance in large-scale manufacturing. In Britain, a craft production strategy was still pursued. Shopfloor workers retained high degrees of control over the production process, and as a result there was less need for investment in management (Broadberry & Wagner 1996).

[37] *Statistik der Bundesrepublik Deutschland*, vol. 90-91 (1954), vol. 246.1-2 (1960)

[38] *Die Industrie der Bundesrepublik Deutschland*, Reihe 4: Sonderveröffentlichungen, No. 11 (1956); *Statistisches Jahrbuch 1958*

Figure 3.4: The share of skilled manual workers and salaried technical personnel in total industrial employment in West Germany (%)



Sources: Statistisches Bundesamt (1954a), '*Statistik der Bundesrepublik Deutschland*', vol. 90-91 (1954), and Statistisches Bundesamt (1960) vol. 246.1-2 (1960). Statistisches Bundesamt (1956d), 'Die Industrie der Bundesrepublik Deutschland', Reihe 4: Sonderveröffentlichungen, No. 11; Statistisches Bundesamt (1959), 'Statistisches Jahrbuch 1958'.

In comparison to the United States British firms were relatively small and even very large firms were usually loose holding companies (Elbaum 1989, 1991). Due to weak managerial hierarchies, craft labour remained important to organise production. According to Elbaum (1991), the adequate supply of both skilled and unskilled labour, combined with the slow development of internal labour markets, meant that British firms had to rely on craft labour or occupational labour markets, rather than internal markets to provide skilled labour.

3.5 Conclusion

In this chapter I have analysed and discussed the sources of Britain's poor economic performance when placed in a comparison with West Germany. With the use of decomposition techniques I was able to show the individual contribution of each industry to the gap in labour-productivity in total manufacturing between West Germany and the United Kingdom. In 1951 a large part of the aggregate gap is the result of Britain's sizable lead in the tobacco industry. I have shown that West Germany's falling behind by 1951 was the result of the sharp deterioration in the principal war industries. West Germany did however, manage to preserve a lead in iron and steel, chemicals and textiles.

The British literature on Britain's relative economic decline during the Golden Age builds partly on the work of Broadberry and Crafts on manufacturing failure. Their premise is that evidently Britain failed during the 1950s and 1960s in manufacturing productivity, and this was one of the causes of its gloomy economic performance. In this chapter I have shown, with use of the pre and post-war labour-productivity estimates that Britain was indeed falling behind West Germany in the 1950s and 1960s. Presumably West Germany already overtook Britain in terms of labour-productivity at the end of the 1950s, as the extrapolation indicates. West Germany clearly forged ahead in the 1960s. However, when I consider the war induced gap in productivity in West Germany, a large part of West Germany's growth acceleration in the 50s can be explained by reconstruction growth. West Germany was bound to get back to its own historical growth path. This growth could not have been mirrored by the UK, since it simply was not as severely damaged by the war, and thus did not experience a war-related output gap of the same magnitude. This reconstruction growth is not capable of explaining the entire gap between German and British productivity. Labour productivity growth rates in West Germany were still significantly higher than British growth rates during the 1960s. By that time we would expect that reconstruction growth would have ended. This means that during the 1960s there is room for British failure. In that sense, the title of this chapter 'Winning the War, Losing the peace' seems to capture the British experience during the Golden Age of economic growth.

My new data contributes to the debate on Britain's relative economic decline because it revealed that West Germany did not secure the largest part of its overtaking in the first years of 1952, as Booth (2003a) has argued. Instead, only a small amount of the total productivity advantage was secured during the first years of the 1950s. This implies that the period of the 1960s is also of crucial importance in the explanation of the British-German productivity race.

Many hypotheses have been put forward to help explain British relative economic decline. This chapter has attempted to add to the debate in some areas. I have used disaggregate industry data to investigate the effect of establishment size. Although I cannot firmly conclude that Britain was failing in Americanisation, I do find evidence that large establishments in Britain were not substantially more productive than smaller sized establishments. An important aspect is also when we should term the British performance as failure. In many industries the American techniques could not be adopted due to specific supply and demand side factors, and hence, it seems questionable to state that entrepreneurs making decisions in such a framework were failing.

Chapter 4

The role of international trade in Britain's relative economic decline. The link between productivity and trade examined

4.1 Introduction

In the debate on Britain's relative economic decline in the post-war era, trade and openness have been mentioned as causes of its relatively weak performance (Broadberry & Leunig 2013, Milward and Brennan, 1996). The Golden Age of economic growth was in essence a period of protectionism in Britain, tariffs remained at their 1930s level through the mid-1960s and the median tariff was twice as high as the West-German level in the late 1950s (Crafts 2012). This chapter investigates whether the degree of Britain's openness had an effect on manufacturing productivity performance.

Britain's failure to become a member of the European Economic Community (EEC) in the early post-war period is mentioned in the literature as a cause of declining competitiveness. When Sir Winston Churchill came back into office in 1951 his government showed very little interest in participation in a European organisation (Clark 1962). At the same time however, industrialists believed that the United Kingdom should become a member of the Common Market, since not being a member meant being excluded from one of the most rapidly expanding markets for specialised products, and high quality consumer goods (Clark 1962, pp. 64-65). However, it was not before 1973 that Britain finally joined as a member of the EEC, and by that time, industries were already too uncompetitive to be able to compete effectively with foreign manufacturing industries (Broadberry and Leunig 2013). Problems with limited competition have been frequently mentioned as an important source of Britain's relative economic decline in the influential work of Broadberry and Crafts.[1]

The relationship between trade and growth has been a subject of great controversy in the economic literature of the past decades. There are multiple channels through which trade and openness can have an effect on growth or productivity.[2] The most important are the market size effect, the possibilities of more scope for learning by doing, knowledge spill-overs, technology transfers, and enhanced competition (Grossman & Helpman 1991; Keller 2002; Melitz 2003; Romer 1987). However, there is considerable disagreement about the nature of the relationship and the possible direction of causality (Hutchison & Singh 1992; Hsiao 1987). Although there is no consensus on the issue, a large literature suggests that differences in growth performance and productivity may be related to variation in international openness.[3] In this chapter I am interested in the relationship between international trade, openness and labour productivity at the industry level in Britain during the post-war era. To fully evaluate to what extent Britain's relative economic decline can be (partly) the result of its trade policies, openness and trade patterns, we first need to investigate whether there are any effects on productivity.

The main contribution of this chapter is to set an important first step in the quantification of the relationship between openness and productivity during the post-war era in the United Kingdom. Although the literature has mentioned Britain's trade patterns and its export performance as a cause of its relative economic decline, there is not much quantitative evidence available to support this claim. This chapter attempts to make a beginning in filling this lacuna. I use labour-productivity growth rates at the disaggregate industry level in manufacturing to examine the relationship between trade and growth. This approach allows me to use quantitative econometric analysis to answer the research question. I present a novel data set of labour-productivity growth rates for 23 industries within manufacturing for the period 1951-1970. Although there are estimates of labour productivity available for this period from O'Mahony (1991), I constructed my own data set because O'Mahony's classification does not match

[1] See e.g. Broadberry and Crafts (2001); and Crafts (2012).
[2] See Redding (1998) for a detailed overview of theoretical linkages.
[3] See e.g. Edwards (1992); Sachs &Warner (1995).

the classification in the trade statistics. By constructing my own data set I am able to include as many industries as possible in the analysis.

I use behavioural measures of openness to examine the relationship between openness and labour-productivity growth. As discussed in the previous chapter catch-up and convergence potential are of substantial importance for the growth in productivity during the period of this study. I therefore control for catch-up and convergence by including a measure of distance from the productivity frontier, which is widely acknowledged to be the United States during this period.

I do not only use labour-productivity growth rates as a dependent variable, I also use data on Multi Factor Productivity as provided by Oulton and O'Mahony (1994). I reclassified their data set to exactly match the industry classification system of the data in the trade statistics. This approach allows me to investigate not only the effect of trade on labour productivity, but also the effect on productivity increases which do not result from a change in the input of capital or the input of labour.

My approach combines imports and exports from the whole world. This ignores the area pattern of trade. In the final section I therefore examine the area pattern of trade in more detail and I investigate whether the origin and destination of trade at the disaggregate manufacturing level have an impact on labour-productivity.

The rest of the chapter is structured as follows. Section 4.2 presents a literature review. Section 4.3 provides a detailed description of the construction of the measures of openness and the novel labour-productivity data set. Section 4.4 develops the theoretical framework and econometric specification. Section 4.5 presents the results of estimation. In this section I will also discuss the robustness checks to verify that the results are not driven by a few outlier industries. In Section 4.6 the focus shifts from labour-productivity growth rates to Multi Factor Productivity growth rates. Section 4.7 discusses the effect of the geographical composition of trade on labour-productivity growth rates. Finally, Section 4.8 summarises and concludes the chapter.

4.2 Literature review

4.2.1 The Commonwealth problem and British 'failure' in international trade

The United Kingdom was once the first major, dominant trading country of the world. At the end of the nineteenth century, Britain was the number one exporting country in the world, responsible for 32.5 per cent of world trade in manufactures (Tyszynski 1951, p. 286, as quoted in Wells 1964, p. 15).[4] Until the First World War, there were no restrictions on international capital mobility, and tariffs were so low that there was virtually a situation of free trade (Crafts 2012).[5] As Moore (1988) points out, the British economy appeared to be a paradigm of an industrial country, exporting manufactures and importing primary goods. Even in 1950 the biggest share of its imports consisted of agricultural goods, whereas eighty per cent of its exports were manufactures. Interestingly enough, between the two world wars most economies turned inwards, and trade in 1950 was at a lower level than trade in 1913 (Krugman, Cooper & Srinivasan 1995). In 1913 Britain's trade share in GDP was 27.7 per cent, whereas by 1950 this was only 13.1 per cent, and even in 1970 it was not back at the pre-World War One level (Krugman et al, 1995). A large part of the growth in trade from 1950 onwards represents recovery to former levels.

Table 4.1 below presents the share of the United Kingdom and other principal manufacturing countries in world trade in manufacturing for the period 1938 to 1959. In 1938, just before the outbreak of the Second World War, Britain was still a bigger exporter than the United States. After the Second World War, the United States became the biggest exporter of manufactured goods in the world, and by 1958 West Germany overtook Britain's position as the world's second largest exporter of manufacturing goods (Wells 1964, p. 3). Clearly, the share of the United Kingdom in total manufacturing trade has fallen substantially during this period. Only the United States experienced a larger decline in this share. West Germany increased its share in world trade the most. We must not forget the obvious fact that the total volume of Britain's production represented a smaller

[4] Trade in manufactures includes Class III of the British Export List 1950, and alcoholic drinks and manufactured tobacco, but excludes coke and refined petroleum.

[5] Whereas at the beginning of the nineteenth century the average custom rates of Great Britain were still up to or over 50 per cent, by 1913 they were lowered till just over 5 per cent (Imlah 1958, Table 11, p. 121 and Table 19, p. 160).

share of world output in the post-war period than during the nineteenth century and the pre-war period.

Table 4.1: Share of world market in trade of manufactures, 1938, 1953-1959

	Percentage shares of principal manufacturing countries								
	1938	1953	1954	1955	1956	1957	1958	1959	Δ1953-1959
United Kingdom	22.1	21.3	20.4	19.7	19.1	18.1	17.9	17.3	-4
United States	20	25.9	25.1	24.5	25.2	25.4	23.3	21.3	-4.6
West Germany	22.7	13.3	14.8	15.5	16.4	17.5	18.5	19.1	5.8
Belgium-Luxembourg	5.9	6.5	6.2	6.5	6.7	6	5.9	6	-0.5
France	6.5	9	9	9.3	7.8	8	8.6	9.2	0.2
Italy and Trieste	2.9	3.3	3.2	3.4	3.6	3.8	4.1	4.5	1.2
Netherlands	3.1	3.7	3.8	3.8	3.5	3.5	3.9	4.2	0.5
Sweden	2.3	2.6	2.8	2.7	2.8	2.9	3.1	3.1	0.5
Switzerland	2.7	4	3.8	3.5	3.4	3.4	3.4	3.4	-0.6
Canada	5.1	6.8	6.3	6.1	5.8	5.5	5.3	5.2	-1.6
Japan	6.6	3.8	4.7	5.1	5.7	6	6	6.7	2.9

Note: 1938 is the whole German Reich, 1953-1959 German Federal Republic only. After the war, exports of the Federal Republic region were approximately two-thirds of those of pre-war Germany.

Source: Wells (1964), Table 1.1, p. 15.

Although in contemporary literature on British relative economic decline, openness and international trade have been mentioned as causes of this process, economists had been relatively silent on issues such as trade policies and the effect of openness on economic performance during the first part of the Golden Age (Wells 1966). In the previous chapters I have compared Britain to West Germany, which is common practice in the discussion on British relative economic decline. When we compare Britain to West Germany in the context of trade and openness, it seems as if the British market was stuck in Commonwealth and colonial trade, whereas West Germany benefited from being integrated into a fast-growing continental bloc in Western Europe. During and after the Second World War, Britain entered in long term contracts to buy primary products from the dominions and the colonies at negotiated prices. At the same time, the West-German economy was booming, and this economic miracle has been seen by many as the consequence of an even more remarkable export miracle (Boltho 1982; Wallich 1955). Between 1950 and 1958 industrial exports of West Germany grew by almost 20 per cent annually (Delhaes-Guenther (2003), p. 17). In the 1960s the growth rate was slower, but still a remarkable 10.6 per cent. Britain was unable to acquire closer integration with the Atlantic countries due to its close involvement with the Commonwealth countries, to such extent that it has been referred to as ‘the Commonwealth problem’ (Wells, 1966).

Britain had high import tariffs as compared to for example West Germany. For the early post-war period attempts have been made to investigate to what extent imports were hindered by these restrictions. Estimates for 1952 and 1954 range between a reduction in imports, as a percentage of actual imports, of 5 to 9 per cent (Milward and Brennan, 1996, p. 139). In 1953 the Committee on the Future of Dollar Saving Industries estimated that output with a value of 314 million pound was protected by quantitative import restrictions, and 270 million pound of this came from production which was very likely to disappear if quota protection against North America ended (Milward and Brennan 1996, pp. 198-199).[6] Hence, the import tariffs had a pronounced effect on the actual imports.

Harold Macmillan announced on 31 July 1961 that Britain planned to start negotiations with the European Economic Community (EEC) with the aim of acquiring full membership (Ludlow 1997). Since Britain was not willing to give up its preferential trade agreements with the Commonwealth countries, the application was vetoed by France in 1963. Another issue in the admission to the European Union was the British Pound Sterling. Although the negotiations focused mainly on trade problems, the issue of sterling as an international currency was an important symbol of the distinct character of Britain’s relations with the rest of the world (Schenk 2010). If Britain became part of the EEC, fixing the sterling exchange rate to the system of stable exchange rates in the area would have implied less policy sovereignty for Britain (Schenk 2010). From the perspective of the EEC sterling posed a problem since in the Treaty of Rome members were committed to offer support when a member experienced balance-of-payment problems (Schenk 2002). Moreover as Schenk (2002) mentions, the weakness of the pound signalled general weakness of the British economy, which implied it was an unattractive partner. Furthermore, Schenk argues that Britain’s attachment to sterling might imply that its interest in policies might deviate from the interest of the EEC, which obviously posed a problem. Thus, Britain’s position to sterling was fundamental for entering the EEC.

In 1960 Britain established a European industrial group, the European Free Trade Association (EFTA), with some smaller non-EEC countries.[7] The other

[6] In 1954 gross output of the manufacturing sector was 18.000 million pound, and value added was about one-third of this.

[7] The founder members of the EFTA were Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the United Kingdom.

nations in the EFTA had relatively small manufacturing sectors and hence, British manufacturing was still relatively isolated from competitive pressure.[8] Broadberry and Leunig (2013) claim that one of the main reasons for the relatively low productivity growth rates of Britain in the 1960s, as compared to for example West Germany or France was this isolation of British firms from foreign competition. According to Broadberry and Leunig, by the time Britain became a member of the EEC, firms were already too uncompetitive. Britain's failure to be a founder member of the European Union might have had significant implications for the development of British manufacturing. Whereas European nations had a relatively similar economic structure, which implies that firms in each country competed with each other in a potentially vigorous manner, Britain and the Commonwealth had a different economic structure, being complementary to each other. Trade between Britain and the Commonwealth was more likely to reduce intra-industry competitive pressure. Therefore, trade with the Commonwealth was not a potential substitute for trade with the EEC. The recent publication of Broadberry and Leunig once more indicates that the debate on British relative economic decline and the possible causes of this decline is still relevant and not settled.

Britain applied again for membership of the EEC in 1967, and was finally admitted in 1973. As Supple (1994, p. 447) describes '*when Britain joined the European Economic Community…that step acknowledged, as few others could have done, the relative weakness rather than the international strength of the polity and the economy*'.

In the literature on British trade policies and openness there has been substantial critique on the export performance during the Golden Age of economic growth. Panić and Seward (1966) mention three points of critique: firstly, the United Kingdom was pricing herself out of the market due to faster rising prices and incomes than in the other major industrialised countries. Wells (1964) stated that higher rates of productivity did not keep pace with the advance in money wages in the United Kingdom, whereas in other advanced countries this was the case. Moore (1964) found that price is indeed important for the export of chemicals and machinery and transport equipment. For chemicals she found a direct price elasticity of more than one, and she found a cross elasticity with respect to the price of other European countries of two for machinery and transport equipment.

[8] Only Denmark and Sweden had a slightly higher GDP per capita than the United Kingdom.

Secondly, an unfavourable export commodity structure might hinder growth of export. This argument basically entails that Britain was not exporting those goods for which demand is rapidly increasing. Although this is a recurrent argument in the literature, Panić and Seward (1966) concluded that the structure of British exports seemed to be no less favourable than that of some of its most important competitors in the period 1959-1964. The National Institute of Economic Review performed a study in 1963 to evaluate whether Britain's commodity pattern of trade was disadvantageous in the period 1954 to 1961. They researched the three most important categories in manufacturing trade: machinery, transport equipment, and chemicals. Products in these groups were split up in fast growing and slow growing products. The share of Britain in fast and slow growing products was compared to the share of a group of advanced countries.[9] The result indicated that Britain did not start the period with significantly different export patterns than the other advanced countries. Britain's fraction of exports in fast growing products was lower than in the total of the advanced countries group, but this difference was not significant.

And thirdly, the United Kingdom exported mainly to areas of low growth whereas it would be more advantageous to sell to dynamic fast growing countries. Wells wrote in 1964 '*Indeed, a high and growing level of export has now come to be regarded as a* <u>sine qua non</u> *of Britain's very existence as an influential trading nation*' (p. xix, original emphasis). One of the reasons for the disappointing export shares was that the Sterling Area became more self-sufficient during the war, and therefore less reliant on British manufactured goods. Moreover, these markets were not growing as fast as the markets to which for example West Germany was exporting. Baldwin (1958 p. 57) found that in the first half of the twentieth century the major cause of the declining export share of Britain, in trade with ten advanced countries, was not the effect of structural change, but rather the effect of competitive weakness.[10] In conclusion, it seems that the spatial pattern of trade, and the price of British exports might have been important in its relative weak export position. The product composition does not seem to have been a driving force.

Between 1955 and 1972 the United Kingdom underwent three successive rounds of most favoured nations tariff reductions. In 1956 the number of duties

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[9] Countries included in this sample are: the United States; the Netherlands; Western Germany; Italy; Belgium-Luxembourg; France; and Japan.

[10] There was a negative structural effect between 1928 and 1952; however, this is solely the result of the declining export of textiles, when textiles are excluded from the analysis only a competitive effect is found.

reduced was small, less than 120 or 3.5 per cent of all tariff headings were affected, and only a few categories were affected (Morgan and Martin 1975, p. 39). The average reduction for all manufacturing was only 0.7 per cent. In 1960-1961 the Dillon Round negotiations, which were implemented on 31 October 1962, affected all major categories of imports of manufactures. Duties were cut by 20 per cent of the existing tariff. Nevertheless, the average reduction of all manufacturing was only 6 per cent. Finally, the most significant change in tariffs was negotiated during the Kennedy Round in 1967. Duties were reduced by fifty per cent for more than half of the manufacturing industries. These cuts were implemented during the period 1967-1972, thus the effects will be of lesser importance for the time frame used in this research. There are no big structural changes in the manufacturing sector during the era 1950-1970, and hence I will treat the entire Golden Age as one period in my research.

4.2.2 The effect of trade on productivity and growth

Many empirical studies on the effect of trade and productivity take a cross country approach, focus at the aggregate economy level, and take for example GDP growth as their measure of growth (see e.g. Barro 1991). In this study I will focus on productivity at the disaggregate industry level because the most important channels through which openness and trade can influence productivity are the competition effect and technology spill-overs, which mainly occur at the disaggregate industry level.[11]

There are multiple channels through which trade and openness can have an effect on growth or productivity.[12] The first channel is the market-size effect. The increased size of the market, due to export opportunities, can lead to an increase in the size of production, which means there might be more scope for learning-by-doing externalities (Grossman & Helpman 1991a; Romer 1987).[13] Another important effect of the increase in market size is that it offers potentially larger rents to successful innovators (Grossman & Helpman 1991a).

The second channel through which international trade can enhance productivity are the possible knowledge spill-overs. Trade induces knowledge spill-overs from more advanced countries and sectors, to less advanced countries and sectors (Grossman & Helpman 1991a; Helpman 1993; Keller 2002). It is well-

[11] Moreover, by evaluating the relationship at the industry level within one country, we avoid the possibility that other factors, such as culture or geography, drive the results.
[12] See Redding 1998 for a detailed review of theoretical links between openness and growth.
[13] See Lucas 1988 for a model where learning-by-doing externalities at the sector level create a link between trade policy and the sectoral trade patterns.

known that cumulative domestic R&D is an important determinant of productivity (Griliches 1988). A country or industry can also benefit from R&D of trade partners by learning about the production process, new technologies, new materials, or organisational methods (Coe & Helpman 1995). This learning can be direct, or indirect via importing goods which embody new technology. Coe and Helpman (1995) found for a sample of 21 OECD countries, and Israel, in the period 1971-1990, that more open economies extract larger benefits from foreign R&D. In neoclassical Solow-type growth models technological change is exogenous, and therefore unaffected by international trade and openness. New growth theory however, endogenizes technological change, and suggests that international trade and openness can have an effect on growth and productivity through its impact on technological change (Cameron, Proudman and Redding 2005; Romer 1990). A third channel through which openness affects productivity is enhanced competition. Competition with foreign counterparts can induce domestic firms to innovate, in order to be able to compete with the new firms. Competition with foreign firms can also enhance productivity growth because competition might force the least productive firms out of the domestic market. However, not all scholars agree that the effect of competition on innovation is positive; very well-known in this respect is the so-called Schumpeterian effect of competition, based on Schumpeter's (1943) early models, which predicted that competition might well discourage innovation, since the expected profits are lowered. Aghion and Howitt (2009) also observe that there is a possibility that firms in a country that is behind the world's technology frontier may be discouraged from innovation after the threat of entry by foreign firms. Even if innovation were successful, the company would lose out from the foreign entrant. Leading endogenous growth models also come to the conclusion that increased competition, or an increase in the rate of imitation, will have a negative effect on productivity growth, since monopoly rents, the reward of innovation, are lowered (see e.g. Aghion & Howitt 1992; Grossman & Helpman 1991b; Romer 1990). According to Marin (1992) whether or not trade expansion will enhance or reduce productivity growth will depend on the competitive conditions on the domestic market.

Although many trade theories emphasize positive learning effects, and spill-overs effects from trade, there can also be an increase in an industry's productivity after exposure to trade without any of these effects taking place. Most famous in this respect is the 2003 article of Melitz, in which he develops a dynamic industry model with heterogeneous firms to analyse the intra-industry effects of trade. The model shows that as a result of exposure to international markets the least productive firms in an industry are forced to exit the market, while the most productive ones stay in the market and export. As a result of this intra-industry effect, the overall productivity of the industry increases (Melitz 2003). Thus, there is no need for a change in the production process. As long as the firms that remain in the industry have a higher level of productivity than those who leave the industry, the overall productivity level will increase.

Another possible negative effect of growth is related to the efficient allocation of resources over sectors as a result of specialisation and comparative advantage. If a country specialises in sectors were it has a comparative advantage, but there is little potential for growth, the aggregate growth rate of the economy may actually fall as a result of international trade (Cameron, Proudman & Redding 1999).

Proudman and Redding (1998) have investigated to what extent international specialisation persists or changed over time for Britain and Germany for the period 1970-1992. They found no increase in the degree of specialisation during this period. Moreover, they were able to demonstrate a considerable change in the international specialisation in British manufacturing. However, further analysis by Cameron, Proudman and Redding (1998) suggested that the explanatory power of these resource allocations was relatively low in explaining aggregate manufacturing productivity.

Cameron et al. (1999) investigated the relation between openness and TFP growth across 19 sectors in manufacturing in the United Kingdom between 1970 and 1992. Using discriminant analysis the manufacturing sectors were sorted into groups on the basis of their measured value of openness. The main finding is that there is a clear cross-sectional association between international openness and TFP growth in manufacturing in the United Kingdom during this period. The group with the most open industries enjoyed significantly higher growth rates than the group containing the least open industries.

In conclusion, there is no consensus on the precise effects of trade on growth or productivity. However, empirical research provides an overwhelming amount of evidence, that trade can have a pronounced effect on productivity. Although the relationship between openness and productivity is complex, there is reason to investigate this relationship for post-war Britain, since the literature perceives openness, trade policy, and trade performance in Britain as a potential important reason for its relatively poor economic performance. Hence, this chapter will contribute to the ongoing debate on the causes of British relative economic decline in the post-war era.

4.3 Data description: data sources and adjustments

The data used in this research is drawn from a number of different sources. The main data sources on which I rely are the '*Historical Record of the Census of Production 1907-1970*' published by the Business Statistics Office (1978) and different volumes of the '*Report on overseas trade*'. The Reports on overseas trade are published by the Board of Trade and the information in these reports is partly based on material presented in the '*Accounts relating to trade and navigation of the United Kingdom*' and partly on other information which is provided by the Statistical Office, H.M. Customs & Excise. The main object of these publications was to summarise statistical material showing the broad pattern of United Kingdom overseas trade (Board of Trade 1950, p. i). Important to note is that the reported imports in these publications are general imports, which means they include also re-exports. Exports, however, are United Kingdom exports, i.e. without re-export. Imports are valued with cost insurance and freight and exports are valued as free on board. These monthly reports are available for the whole period studied in this Section. The report is published at a monthly interval. Below I will specify how I constructed the novel labour-productivity data set, how the distance to the productivity frontier is calculated, and how the trade measures are created.

4.3.1 Openness measures

One issue in studies on openness and productivity is the definition of openness. Although, as Cameron et al. (1999) argue, the definition may conceptually be quite clear, moving to an empirical definition is more problematical. According to Cameron et al. (1999, p. 7) '*an industry or economy is said to be more open the smaller the extent of barriers to the free movement of goods and services, factors of production and ideas*'. This is in line with recent research, were the meaning of openness has become similar to the notion of free trade, a system of trade where barriers are removed (Yanikkaya 2003). However, not all scholars agree with the idea that the definition is clear, and empirical research has used many different definitions (Yanikkaya 2003). Most studies that examined the relationship between openness and economic growth have relied on trade volumes as a measure of openness. The simplest measures of trade are behavioural measures based on actual trade flows, such as for example imports as a share of home consumption, or exports as a share of production. These behavioural measures are endogenous outcomes of trade policy and other economic factors, and the growth rate might be part of these factors. Using behavioural measures is therefore only valid if they are correlated with an underlying measure of trade policy, or international openness (Cameron et al. 1999). Direct measures of trade barriers, such as tariff rates, coverage of tariffs and nontariff barriers are usually more difficult to use in quantitative research. A first problem that arises when applying these data is how to construct an overall industry index. In many cases there are specific tariffs for goods which fall under the same heading.[14] Deciding how to weight all these specific tariffs can be a daunting process. Using the actual import shares as a weight can be deceptive, since high tariffs might discourage imports, and thereby this method gives too little weight to these high tariffs. Although empirical research uses behavioural measures of trade and openness, the theoretical growth literature has focused mainly on the relationship between trade policies and growth, instead of trade volumes and growth (Yanikkaya 2003).

There has been a discussion in the literature on whether exports or imports are more important for growth. Early literature tends to focus on exports, as discussed by Edwards (1993). However, given the possible linkages between trade and growth outlined above, it makes sense to also focus on imports, since imports are responsible for the competitive effect and the spill-over effects. Rodrik (1999) also claims that the benefits of openness stem from the import side, and according to him focus should lie on imports. According to the theory of comparative advantage, international trade leads to a more efficient use of resources, through the option of importing goods which a country does not possess, or which are simply too costly to produce (Yanikkaya 2003). In this research, I will focus on both imports and exports. Imports are essential since the competition effect is an important explanation in the discussion of British failure (Crafts 2012). Exports are important for the debate since Britain has been criticised for its relatively bad export performance, see for example Panić and Seward 1966.

I have constructed two measures of openness, in which I follow the approach taken by Cameron, Proudman and Redding (1999). The first measure is the share of exports to the whole world in domestic production (*XGO*). Which is calculated as exports (*X*) from manufacturing industry *i* at time *t*, as a share of domestic production in industry *i* at time *t*, which is measured by gross output (*GO*).

$$XGO_{it} = \frac{X_{it}}{GO_{it}} \quad \textbf{(4.1)}$$

[14] For example, within the product group ‘Paper for diaries and periodicals’, which seems to be a relatively homogeneous group of products, the tariff ranges from 0 to 16, 2/3 per cent depending on the specifics of the paper. i.e. (see PEP 1962, p. 172, and p. 311).

The second measure I use is based on imports. I take imports from the whole world as a share of home sales. Home sales are proxied by adding imports to domestic production (measured by gross output) and deducting exports from domestic production. The resulting ratio is calculated by dividing the imports from industry *i* in year *t* over the home sales from industry *i* in year *t*.

$$MS_{it} = \frac{M_{it}}{GO_{it} - X_{it} + M_{it}} \quad \textbf{(4.2)}$$

I use data on exports and imports from various volumes of the '*Report on overseas trade*' to construct these behavioural measures of openness. One caveat is that the classification of industries in these reports changed during the period. Moreover, the reports do not provide information on all industries separately. Therefore, it is not possible to have a complete series for all manufacturing industries and all years. It was possible to obtain data on 23 industries, for almost the complete period under investigation. These 23 industries together accounted for more than 76 per cent of value added in 1951, and for more than 85 per cent of value added in 1970. Hence, the majority of manufacturing is covered by this sample. In some cases data is missing for a few years, or there is only data for import, and not for export, or vice versa. Where possible these gaps are interpolated or guesstimated. Appendix A3 provides detailed information on the procedures undertaken.

The data from the reports on overseas trade do not specify to which industry the imports are designated. For example, there is one entry of textiles import, but it is not specified whether these imports go to the UK's textiles industry to undergo further processing, or whether this is an input into the clothing sector. This implies, that when we use imports in a measure of openness, we are not able to take into account all possible channels through which imports can affect productivity. Basically, the import measure of openness is a measure of import competition. This measure is less capable of capturing technology spill-over effects at the disaggregate industry level. Exports obviously originate from the same industry as classified in the trade statistics, and by constructing an openness measure with export the market size effects are taken into account.

Tables 4.2 and 4.3 display information on the ratios of imports to home sales (*MS*), and exports to domestic output (*XGO*) over the period 1950-1970. The variation across industries is substantial, in the leather (manufactured) industry the share of export in gross output was almost 66 per cent in 1970, whereas for wood (basic materials) industry the share was never as much as 1 per cent during this period. If we look at the export share in domestic output for the total of the 23 industries in the sample, we see that openness in 1970 is only marginally larger than in 1950. However, when we look at individual industries there are substantial changes in openness during the period under consideration. For example the non-ferrous metals industry, the rubber industry and the leather (manufactured) industry exported a much larger share of gross output in 1970 than in 1950, whereas in the textiles industry, the transport equipment industry, and the oils and greases industry, the amount of export as a percentage of gross output decreased substantially.

When we examine the import share in home sales more closely we see a similar pattern, in the sense that the *MS* ratio hardly changed for the total of the 23 industries. However, there are sizable changes within individual industries. For example the dependency of the meat industry and the dairy industry on imports was declining during this period, whereas for the mechanical engineering industry it was rising. The ranking in terms of most open industry, measured by either *MS* or *YGO* is not constant over time.

Table 4.2: Imports as a percentage of home sales in the United Kingdom (1950-1970)

Industry	1950 (%)	1970 (%)	Min. period 1950-1970 (%)	Max. period 1950-1970 (%)	Annual average 1950-1970 (%)
Meat Industry	64.87	36.25	36.25	64.87	51.72
Dairy Industry	34.80	16.44	16.44	51.55	37.20
Fruits and Vegetables Industry	62.56	48.38	48.38	62.93	55.74
Tobacco	8.23	6.33	5.89	9.91	7.70
Beverages	3.01	3.91	3.01	4.71	3.93
Leather (manufactured)	46.14	55.40	37.87	61.58	48.40
Paper	21.74	24.76	21.74	32.67	23.92
Wood (basic materials)	35.78	25.56	25.56	56.09	39.07
Wood (manufactured)	31.85	35.50	28.42	42.72	36.54
Leather (basic materials)	29.57	34.54	28.36	37.61	32.32
Non-Ferrous Metals	34.46	48.70	34.46	50.71	40.37
Oils and Greases	54.95	57.08	39.58	58.73	49.79
Textiles (basic materials)	20.79	10.47	10.47	23.47	17.15
Rubber (manufactured)	0.14	2.27	0.14	2.34	1.51
Clothing	2.01	13.64	1.06	14.14	6.46
Footwear	1.65	13.40	1.41	13.40	6.56
Iron and Steel	3.12	7.86	2.42	10.46	5.13
Electrical Engineering	1.50	10.18	1.50	10.18	4.58
Mechanical Engineering	7.52	20.33	6.44	20.33	12.39
Chemicals	9.39	14.84	7.94	14.84	10.73
Textiles (manufactured)	20.12	22.29	10.61	28.77	21.65
Transport Equipment	2.36	6.67	1.54	8.72	3.34
Optical and Precision Engineering	13.10	24.28	13.10	24.28	17.51
Total 23 industries	16.29	16.40	13.85	19.19	15.61

Source: own calculations, see text for the underlying sources.

Table 4.3: Exports as a percentage of gross output in the United Kingdom (1950-1970)

	1950 (%)	1970 (%)	Min. period 1950-1970 (%)	Max. period 1950-1970 (%)	Annual average 1950-1970 (%)
Meat Industry	1.08	1.80	1.08	2.58	1.78
Dairy Industry	0.81	1.51	0.81	4.62	2.67
Fruits and Vegetables Industry	4.84	5.19	3.41	7.79	4.83
Tobacco	2.62	2.40	1.30	3.35	2.18
Beverages	6.11	10.37	6.11	11.36	7.85
Leather (manufactured)	49.60	65.95	35.94	68.63	48.26
Paper	9.05	6.64	5.35	9.13	6.71
Wood (basic materials)	0.10	0.40	0.10	0.42	0.33
Wood (manufactured)	3.18	4.00	2.65	4.09	3.71
Leather (basic materials)	1.55	6.75	1.55	6.97	3.71
Non-Ferrous Metals	21.54	35.35	14.84	36.59	23.39
Oils and Greases	18.00	10.93	7.39	21.02	12.61
Textiles (basic materials)	2.17	5.77	2.16	7.12	5.35
Rubber (manufactured)	5.14	14.06	3.87	15.33	11.48
Clothing	7.78	13.06	5.05	13.06	7.20
Footwear	6.54	11.93	5.38	12.33	7.36
Iron and Steel	16.81	11.76	9.80	16.81	11.82
Electrical Engineering	24.33	16.09	13.12	24.33	17.43
Mechanical Engineering	36.77	32.88	27.47	36.77	31.65
Chemicals	20.33	20.15	16.49	23.37	18.33
Textiles (manufactured)	51.17	30.75	27.16	59.12	40.15
Transport Equipment	31.60	20.54	17.72	32.77	21.49
Optical and Precision Engineering	27.00	32.09	22.89	32.09	26.91
Total 23 industries	16.29	16.40	14.87	17.38	15.84

Source: own calculations, see text for the underlying sources.

4.3.2 A novel labour-productivity data set

I constructed a novel data set on labour-productivity, since existing data sets were not suited for the analysis I wish to make. The most important reason for this is that I have to rely on the classification of industries as in the trade statistics. Existing labour-productivity estimates do not cover the same industries as I have in the sample I took based on the reports on overseas trade.

I calculated annual labour-productivity levels for 23 industries on the basis of value added and employment information by industry from the '*Historical Record of the Census of Production 1907-1970*' which is published by the Business Statistics Office (1978). I have reclassified the industries presented in the census in order to make them comparable to the classification from the Reports on overseas trade. Table A-3.6 in the Appendix provides the details on this reclassification. Value added data was reported in current prices; therefore a wholesale price index was used to convert to constant prices. The wholesale price index from the census had some gaps, which I interpolated or guesstimated using data on retail prices or data from other sources. Table A-3.7 in the Appendix provides detailed information on the procedure undertaken. Unfortunately the data on value added and employment in the census is not available at yearly intervals but it was possible to interpolate the data using index numbers for employment and industrial output.[15] The yearly index of production is available from the 'Annual Abstract of Statistics' and employment information is taken from the '*British Labour Statistics: Historical Abstract 1886-1968*'. Appendix Table A-3.7 explains in detail the procedure undertaken to interpolate the data.

I adjusted the employment data for hours worked, since on average the number of hours worked in manufacturing declined with 7 per cent in the period 1950-1970.[16] Without correcting for this change we would overestimate productivity in those years where there were still long working weeks. Data on hours worked is obtained from O'Mahony (1999). As a result of the Korean War in 1950, North America and Western Europe, except the Federal Republic, rearmed. The war led to a rapid increase in the demand for primary products, and this resulted in skyrocketing prices (Moore 1985, p.35).[17] Due to the large increase in prices labour-productivity growth rates, calculated as constant price value added per hour, are negative for many industries, however, this is mainly a statistical effect and not so much an actual productivity effect. This problem manifests itself only in the early 1950s. In the estimation I will control for this.

4.3.3 Distance to the productivity frontier

I will include a measure of the distance to the frontier in my analysis since this can be an important explanation in labour-productivity growth. Catch-up and

[15] Detailed industry information is available for 1948, 1950, 1951, 1954, 1958, 1963, 1968 and 1970. For some industries data is also available for 1949, 1950, 1952, 1953, 1955, 1956, and 1957.
[16] Own calculation based on O'Mahony (1999), Table C, page 96.
[17] The price effect is also found in studies on other countries, for example De Jong (2003) found this effect for the Netherlands.

convergence theories predict faster growth for those industries further from the technology frontier. Leading scholars such as Abramovitz (1986) and Baumol (1986), and many others, interpret convergence as the process of follower countries that catch-up to leader countries by adopting the technologies from these countries. In later literature, most notably by Barro (1991) and Mankiw, Romer and Weil (1991), the driving force behind convergence is diminishing returns to factors of production. After the Second World War, the United States was the world's most productive economy and the productivity leader in virtually every industry (Nelson and Wright, 1999). To control for the distance to the frontier and the possible catch-up opportunities I include a measure of distance to the frontier (*DTF*). Cameron, Proudman and Redding (1997) found in their investigation of the impact of openness on rates of productivity growth in the United Kingdom for the period 1970-1990, that there is clear evidence that the levels of relative productivity in the United Kingdom and the United States are an important determinant of the productivity growth rate in the United Kingdom.

The *DTF* measure is defined as productivity, in terms of value added (Y) per hour worked in manufacturing industry *i*, at time *t*, in the leader country (the United States) over the productivity per hour worked in the follower country (the United Kingdom). Hence, I use the following measure:

$$DTF_{it} = LP_{it}^{L}/LP_{it}^{F} \quad \textbf{(4.3)}$$

Where LP_{it}^{L} is the labour productivity level in the leader country (the United States) in industry i in year t, and LP_{it}^{F} is the labour productivity in the United Kingdom in industry i in year t. Although the United States is generally regarded as the technological most advanced nation of the world in the 1950s and 1960s, Britain might have benefitted from technology transfer from another country that has a higher technological level than Britain but a lower level than the US. Thus, the assumption I rely on is that the distance from the technology frontier is correlated with the potential for technology catch-up.[18]

I base my estimate of labour productivity on a comparison between the United States and the United Kingdom for 1950 offered by Paige and Bombach (1959). The advantage of the data set they provide is that they have used industry specific PPPs to convert output in the two nations. This method is clearly preferred over other alternatives, such as using an exchange rate or the Purchasing Power Parities (PPPs) as for example calculated by the International Comparison Program (2005).

[18] I follow Griffith, Redding and van Reenen (2004) in making this assumption.

Moreover, their method closely matches the method I have used in the previous chapters to calculate labour-productivity benchmarks for West Germany and the United Kingdom in the pre and post-war period.

I reclassified the estimates of Paige and Bombach to match the industry classification used in this chapter. Table A-3.8 in the Appendix provides more detail on the reclassification. Moreover, I adjusted the gaps by taking into account hours worked, for which I relied on data from O'Mahony 1999. As discussed in the previous chapters this is a very important and valuable adjustment, since hours worked can have a substantial impact on the resulting labour-productivity levels calculated when there is a significant difference in the reported hours in the two countries under consideration. I extrapolated the industry data to 1970 using for the United States data on output and employment from the '*Historical statistics of the United States, volume 4, Economic sectors*' and wholesale prices are taken from '*Historical Statistics of the United States, volume 3, Economic structures and performance*'. For the United Kingdom I relied on the data from the '*Historical Record of the Census of Production 1907-1970*' which I interpolated to obtain annual estimates. As discussed in Chapter 2, we should be careful in extrapolating labour-productivity estimates too far from the actual benchmark, because there is a danger of obtaining results which deviate substantially from the actual productivity levels achieved. Thus, we should be careful in interpreting the results. However, since the industry-specific gap used in this analysis is simply a proxy for the actual distance to the technology frontier, it is not to be expected that this will pose large problems in the analyses.[19] It is to be expected that there is a high correlation between the *DTF* and the actual distance to the frontier.

Table 4.4 below presents the substantial variation in levels of relative labour productivity across the sample of industries for 1950 and 1970. The gap between the United Kingdom and the United States clearly became smaller during this period. However, the process and speed of catching up is not the same for all industries.

[19] Smith, Hitchens and Davies (1982) report a US/UK labour-productivity benchmark for the year 1967/1968. However, as discussed in section 2.6 in Chapter 2, their method deviates substantially from the method that I have used in Chapter 2. It also deviates from the method Paige and Bombach have used. In my point of view the method of Paige and Bombach is clearly superior to the method chosen by Smith et al. It is not possible to connect the estimates of Smith et al. to the estimates of Paige and Bombach due to the difference in the underlying methodology applied.

Table 4.4: Levels of relative labour productivity US/UK in 1950 and 1970 (UK =100)

	1950	1970
Meat Industry	159	198
Dairy Industry	245	182
Fruits and Vegetables Industry	226	285
Tobacco	251	425
Beverages	283	182
Leather (manufactured)	204	197
Paper	484	450
Wood (basic materials)	354	275
wood (manufactured)	277	224
Leather (basic materials)	235	237
Non-Ferrous Metals	296	317
Oils and Greases	221	287
Textiles (basic materials)	264	194
Rubber (manufactured)	199	195
Clothing	212	168
Footwear	192	150
Iron and Steel	314	294
Electrical Engineering	344	229
Mechanical Engineering	352	363
Chemicals	359	320
Textiles (manufactured)	240	159
Transport Equipment	364	408
Optical and Precision Engineering	332	380

Source: own calculations, see text for the underlying sources.

In 1950 Britain is performing relatively the worst in the paper industry, where the United States is more than four times as productive. Britain is performing relatively well in meat industry, footwear industry, and rubber industry, in which the United States is less than two times more productive. By 1970 we see that for over half of the industries the difference in labour-productivity levels became smaller. Table 4.5 presents the percentage distribution of value added in the United Kingdom for 1950, 1960 and 1970. The industries in which its performance worsened as compared to 1950 constituted 35 per cent of the total value added of the 23 industries in 1970. Transport equipment and mechanical engineering accounted for more than one-quarter of value added produced. In mechanical engineering the British position worsened, although it was only by a few percentage points. Although we should be careful to give too much confidence to the estimates of the 1970 labour-productivity gap, it can be concluded that the period is characterised by an overall convergence of UK labour-productivity levels towards US levels.

Table 4.5: Percentage distribution of value added in the United Kingdom in 1950, 1960, 1970, current prices (total of 23 industries =100)

	1950 (%)	1960 (%)	1970 (%)
Meat Industry	0.67	1.02	1.52
Dairy Industry	1.45	0.65	1.45
Fruits and Vegetables Industry	0.98	1.03	1.10
Tobacco	2.03	1.47	1.46
Beverages	3.69	4.37	4.56
Leather (manufactured)	0.47	0.33	0.27
Paper	4.55	4.65	4.13
Wood (basic materials)	2.12	1.69	1.85
Wood (manufactured)	0.80	0.78	2.37
Leather (basic materials)	1.16	0.43	0.34
Non-Ferrous Metals	2.25	1.75	1.48
Oils and Greases	0.45	0.40	0.23
Textiles (basic materials)	11.31	7.16	5.57
Rubber (manufactured)	1.97	2.10	2.51
Clothing	6.09	5.15	4.33
Footwear	1.94	1.73	1.46
Iron and Steel	10.77	8.33	6.80
Electrical Engineering	8.14	10.05	10.97
Mechanical Engineering	6.93	12.55	12.62
Chemicals	9.57	13.27	16.22
Textiles (manufactured)	4.88	4.91	4.83
Transport Equipment	16.34	14.70	11.90
Optical and Precision Engineering	1.44	1.49	2.03

Source: own calculations based on Business Statistics Office (1978), ‘Historical record of the Census of Production 1907-1970’.

4.4 Theoretical framework and econometric specification

This section outlines the theoretical framework underlying my modelling strategy. I denote manufacturing industries by i = 1, …,N and years by t =1..,T. Value added (Y) in each manufacturing industry i at time t is produced according to a standard production technology using capital (K) and labour (L)

$$Y_{it} = A_{it}(L_{it}, K_{it}) \qquad \textbf{(4.4)}$$

Labour productivity (LP) in a given industry (i) is defined as value added (Y) in manufacturing sector i, produced at time t, per man-hour.

$$LP_{it} = \frac{Y_{it}}{H_{it}} \qquad \textbf{(4.5)}$$

Where H_{it} is the total hours worked in industry i in year t.

Although it is possible to estimate the effect of openness for each industry separately, there are disadvantages to this approach. The number of degrees of freedom will be very small given the relatively short time period in the data. Moreover, omitted variable biases can be severe. Therefore, I construct a panel data set with 23 manufacturing industries for the period 1951-1970. From the literature we know that some factors which affect productivity growth might well differ over industries. These differences, such as for example institutional factors, are hard to measure at the industry level. It is possible that these unobserved industry-characteristics are correlated with the explanatory variables. To control for this unobserved heterogeneity that is correlated with the explanatory variable I use industry dummies, which function as industry fixed effects. This approach reduced the potential of omitted variable bias substantially, and increases the degrees of freedom.

I also include a full set of time dummies, since there might also be some shocks to the economy that hit all industries. I will regress the measures of openness and the measure of the distance to the frontier on labour-productivity growth. The following equation is estimated:

$$\Delta LP_{it} = \alpha + \beta_1 DTF_{it} + \beta_2 MS_{it} + \beta_3 XGO_{it} + \sum_{t=1}^{T} \gamma_t + \sum_{i=1}^{N} \vartheta_i + \varepsilon_{it} \qquad \textbf{(4.6)}$$

Where ΔLP_{it} is the growth rate of labour productivity, as measured by value added per hour worked, in industry i in year t. DTF_{it} measures the gap in labour productivity between industry i in year t in the United Kingdom and industry i in year t in the technology frontier of the world, the United States. By including the distance to the frontier, I take catch-up effects into account. MS_{it} is imports over domestic sales for industry i in year t, and XY_{it} is export over domestic production for industry i in year t. The import measure of openness is theoretically related to the competition effect, whereas the export measure of openness should capture the possible positive externalities of the market size effect, such as possibilities for reaping scale economies. $\sum_{t=1}^{T} \gamma_t$ are the year dummies and $\sum_{i=1}^{N} \vartheta_i$ are the industry dummies which function as fixed effects. ε_{it} is a serially uncorrelated error.

We need to consider a potential problem that might result from using this estimation strategy. It might well be that the openness measures are not strictly exogenous. External shocks to the economy, captured in ε_{it}, can have an effect on imports and exports, and hence on the openness measures. Obviously, behavioural measures of openness are prone to endogeneity problems. This will be the case for direct measures of trade policies as well, although the problem may be less pronounced. I use an instrumental variables approach to avoid the problem of endogeneity. In the next section the results of estimating equation 4.6 are presented.

4.5 Results

I use a two-stage least square instrumental variable approach to estimate equation 4.6. I apply a two-year lag of the openness measures and the distance to the frontier measure as instruments for the explanatory variables in the regression. I have chosen a two-year lag length since this is theoretically large enough to avoid endogeneity issues, and it assures that the time dimension of the data set does not become too short. Taking a lag of more years becomes problematic since in that case many observations in the beginning of the 1950s are lost, which leads to lower degrees of freedom in the estimation strategy. I lose the observation for 1950, which given the disturbing effects of the Korean War is not a problem.

Although theoretically it seems reasonable to assume that *MS*, *XGO* and *DTF* are endogenous, I have tested this assumption after performing the two-stage-least square instrumental variable estimation. I have used the Wooldridge's (1995) robust score test and a robust regression based test of exogeneity, since these tests are robust to heteroskedasticity.[20] Table 4.6 shows the outcome of both tests. Both tests reject the null hypothesis that all variables are exogenous, hence I should treat all three explanatory variables as endogenous

Table 4.6: Exogeneity tests for explanatory variables

H0: all variables are exogenous	Test static	p-value
Robust score chi-square	37.453	<0.001
Robust regression F (3,390)	12.904	<0.001

The instruments used in an instrumental variable regression need to be strong and valid. To test whether my proposed instruments are strong and significant I use the relation between the T-static and the F-statistic.[21] If the T-statistic is larger than 3.16 this implies the F-statistic is larger than 10, and hence it is possible to conclude that the instrument is strong. Table A-3.9 in the Appendix shows the first stage result of the estimation of equation 4.6. The result indicates that, as expected, the two-year lag of *MS* is a strong instrument for *MS,* the two-year lag of *XGO* is a strong instrument for *XGO* and the two-year lag of *DTF* is a strong instrument for *DTF*.

[20] Both tests can tolerate autocorrelated errors.

[21] The square of the T-statistic is the F-statistic. To reject that an instrument z_1 is weak, the usual rule of thumb is that the F-statistic for the null hypothesis H0: $\theta = 0$ should be larger than 10 (where θ is the coefficient of z_1 in a regression where the endogenous variable is the dependent variable, and all other exogenous variables are included as well) (Hill, Griffith and Lim 2012).

One potential problem with the openness measures is that the import and export data are relatively volatile, which implies there can be relatively large variations from year to year. To reduce the effect of this annual variation I used the three-year moving average of the *MS* and *XGO* measure as instruments as well. It means that for the observation of each year I take the average of the preceding year, the current year, and the next year.[22] Hence, for example for the year 1952 I use the average observations of *MS* and *XGO* for industry *i* for 1951, 1952, and 1953. To avoid endogeneity issues I take the two-year lag of these newly created variables. Table A-3.10 in the Appendix shows the first stage result of the estimation of equation 4.6 when the two-year lags of the three-year moving average *MS* and *XGO* are used. The results indicate that, as expected, the two-year lag of the three-year moving average of *MS* is a strong instrument for *MS*, the two-year lag of the three-year moving average of *XGO* is a strong instrument for *XGO* and the two-year lag of *DTF* is a strong instrument for *DTF*.

Table 4.7 below presents the second stage estimation results. In column one, I have used the two-year lag of the endogenous variables as instruments, and in column two I have used the two-year lag of the three-year moving average of the openness measures, and the two-year lag of the *DTF* measure as instruments. In columns 1 and 2 the estimated coefficient for the export measure of openness is positive, and statistically significant. The measure of openness based on imports is not statistically significant at the conventional levels. However, given the p-value of 0.12 it is significant at a slightly higher level, and given the small size of the data set this might still be seen as indicating statistical significance.

Whether a two-year lag of the endogenous variables or a moving average is used does not substantially affect the estimation. Hence, these results indicate that there is indeed an effect of openness on the labour-productivity growth rate. But only the export measure of openness seems to be capable of capturing this effect. This might imply that the competition effect, which the import measure of openness should capture, does not have a pronounced effect of labour-productivity growth. Alternatively, it might also be the case that high levels of import in industries imply that these industries are not competitive enough to supply the home market. Hence, we should also expect lower labour-productivity growth in these industries. The estimated coefficient for the distance to the frontier measure is positive in all estimations. So, the further an industry is from the technology

[22] The three-year moving average of *MS* is calculated as the average of the observations of three time periods: $\mathrm{MovingaverageMS} = (\mathrm{MS}_{i,t-1} + \mathrm{MS}_{i,t} + \mathrm{MS}_{i,t+1})/3$.
Similarly, $\mathrm{MovingaverageXGO} = (\mathrm{XGO}_{i,t-1} + \mathrm{XGO}_{i,t} + \mathrm{XGO}_{i,t+1})/3$

frontier, the higher the growth rate of labour productivity. This result confirms the hypothesis that the distance to the frontier has an impact on labour-productivity growth.

Obviously not all industries have an equal size. Columns 3 and 4 show the result when industries are weighted by their average share, over the period 1950-1970, in gross output. This approach ensures that we can test whether the result is driven by some form of heterogeneity across industries. Column 3 shows the result when the two-year lags of the explanatory variables are used as an instrument, and column 4 shows the result when the lags of the three-year moving averages of the explanatory variables are used. The estimated coefficients are not substantially different from the estimation in columns 1 and 2. The reason that the coefficient for the export measure of openness is slightly lower in columns 3 and 4 is probably that the effect of openness is somewhat smaller for the industries which have a larger weight in gross output. However, the difference in coefficients is small, and the newly estimated coefficients are well within the 95 per cent interval of the coefficients estimated without any weighting scheme.

Table 4.7: Instrumental variable estimation result

	Dependent variable: *LP* growth rate			
	1[a]	2	3[c]	4
YGO	0.342***	0.340***	0.329**	0.312**
	(0.118)	(0.115)	(0.142)	(0.145)
MS	0.165	-0.003	0.120	0.027
	(0.145)	(0.115)	(0.229)	(0.195)
DTF	0.067***	0.067***	0.056**	0.055**
	(0.021)	(0.021)	(0.025)	(0.025)
Constant	-0.297***	-0.263***	-0.280***	-0.255***
	(0.085)	(0.083)	(0.090)	(0.092)
Wald chisquare (p-value)	141.67	137.10	150.38	148.38
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
N	437	437	437	437

Results of time fixed effects and industry dummies are suppressed

Robust standard errors in parenthesis. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

The coefficient for the export measure of openness ranges from 0.342 to 0.312 in the four estimations presented in Table 4.7. If we focus on the un-weighted estimation in column 1 and 2, we can see that, keeping everything else constant, if *XGO* increases by 1 unit, the growth rate of labour productivity increases by 0.34 units. An example will make clear how large the effect is. The average labour-productivity growth rate per annum in the paper industry during the period 1951-1970 was 3.74 per cent. The average *XGO* measure for the period was 6.7, thus just under 7 per cent of the produced gross output was exported. If this industry had instead exported ten percent of its gross output, that would imply a 3.3 point increase in XGO, which leads to an increase of 0.34 * 3.3 = 1.122 in the labour productivity growth rate. Hence, the resulting labour-productivity growth rate would, keeping everything else constant, be equal to 4.86 per cent per annum. Over a period of twenty years, this results in an increase in labour-productivity levels of well over 20 per cent. The effect suggested by the estimation is quite substantial, which means that for the period under consideration openness has clearly a pronounced effect on the labour-productivity growth rate.

However, we should be careful in interpreting these results, since they do not necessarily represent structural coefficients. There is no theoretical model underlying the estimation strategy. But the results indicate nevertheless that a small increase in the share of export in gross output leads to a relatively large increase of the labour-productivity growth rate, keeping everything else unchanged. Obviously, it will not be possible for an industry to simply increase exports by a large share without implications. In the example of the paper industry above, I suggested an increase in the *XGO* ratio from 6.7 to 10, which is an increase of almost 50 per cent in exports. An important question then becomes how large an increase in the export share of gross output would have been realistic, if British trade policies were different. Answering this question is outside the scope of this dissertation, and should be the topic of further research. This analysis succeeded in providing empirical evidence that international openness did have a significant effect on labour-productivity growth rates in British manufacturing industries during the Golden Age of economic growth. Thus, lack of openness and trade should be seen as a cause of Britain's relative economic decline. However, the analysis is not able to pinpoint the exact channels through which openness had an effect on growth. As the literature review made clear, there are some obvious candidates, such as the competition and the market size effect.

The fact that in this analysis the import measure of openness is not significant, whereas the export measure of openness is, suggests that apparently the market size effect has a bigger impact on labour-productivity growth than the competition effect. However, the fact that exports are important for labour-productivity growth can also mean that Melitz type of composition effects are at work. Trade, and especially export, can lead to a shift in the firms active in an industry, with higher overall labour-productivity level as a result. This, however, does not necessarily imply a change in the production function within these firms. It would be interesting to redo the analysis with detailed information on the imports of intermediary and final goods at the industry level. Intermediary goods are supposed to facilitate technology transfer, since it offers the buying industry a chance to learn about the technology and to reproduce it. Unfortunately, this data is not readily available. Detailed data on the type of products imported and exported is available in the various volumes of '*Accounts relating to trade and navigation in the United Kingdom during each month during the year*'. However, these data impose some problems when one wants to focus solely on intermediary goods, since quite often a product group described in these data consists of both final goods, and intermediary goods. Hence, constructing a database with final and intermediary goods is a formidable task, a great challenge for further research.

4.5.1 Robustness checks

Having established through estimation of equation 4.6 that there is a strong relation between openness and labour-productivity growth levels in the United Kingdom, I now consider the robustness of this relationship to the exclusion of outlier industries. I re-estimate equation 4.6 with an instrumental variable approach where I use the two-year lag of the moving average of *XGO* and *MS* and the two-year lag of *DTF* as instruments. I exclude the three outlier industries, with the highest and lowest levels of respectively the import measure of openness the export measure of openness, the distance to the frontier, and the labour-productivity growth rate. This approach allows us to verify that my parameter estimates are not driven by outlier industries. Table 4.8 presents the results.

Table 4.8: Two-stage least square instrumental variable estimation

	Dependent variable: *LP* growth							
	1[a]	2[b]	3[c]	4[d]	5[e]	6[f]	7[g]	9[h]
YGO	0.266**	0.317**	0.685**	0.352***	0.530**	0.305**	0.326***	0.519**
	(0.130)	(0.126)	(0.287)	(0.129)	(0.232)	(0.123)	(0.115)	(0.226)
MS	-0.015	0.016	-0.121	0.023	-0.103	-0.013	-0.011	-0.079
	(0.149)	(0.108)	(0.120)	(0.172)	(0.116)	(0.114)	(0.112)	(0.125)
DTF	0.066***	0.073***	0.064***	0.091***	0.067***	0.062***	0.056***	0.062***
	(0.022)	(0.021)	(0.021)	(0.038)	(0.022)	(0.019)	(0.034)	(0.021)
Constant	-0.231***	-0.274***	-0.329***	-0.364***	-0.312***	-0.241***	-0.225*	-0.293***
	(0.088)	(0.085)	(0.117)	(0.136)	(0.111)	(0.077)	(0.119)	(0.108)
Wald chi-square	140.30	126.13	118.66	108.31	113.47	122.74	132.11	124.41
(p-value)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
N	380	380	380	380	380	380	380	380

Results of time fixed effects and industry dummies are suppressed

Robust standard errors in parentheses. Estimates marked ***/**/* are significant at the 1/5/10 per cent level. Instrumented: MS, XGO, DTF. Instruments: L2.MovingaverageXGO; L2.MovingaverageMS, L2.DTF, year dummies 1953-1969, Trend.

a) The three industries with the highest average value of *MS* (fruits and vegetables; meat; oils and greases) are excluded.

b) The three industries with the lowest average value of *MS* (rubber; transport equipment; beverages) are excluded.

c) The three industries with the highest average value of *XGO* (leather (manufactured); textiles (manufactured); mechanical engineering), are excluded.

d) The three industries with the lowest average value of *XGO* (meat; tobacco; wood (basic materials)) are excluded.

e) The three industries with the highest *LP* growth rate, (chemicals; beverages; textiles (manufactured) are excluded.

f) The three industries with the lowest *LP* growth rate (leather (basic materials); iron and steel; non-ferrous metals) are excluded.

g) The three industries with the largest Distance to the Frontier (chemicals; paper; tobacco) are excluded.

h) The three industries with the smallest Distance to the Frontier (clothing; footwear; textiles (manufactured) are excluded.

When we observe the results we see that in most of the columns the results are very close to the results in table 4.7. The estimated coefficients fall within the 95 per cent interval of the estimated coefficients in table 4.7 for most of the columns. Only the estimated coefficient for the export measure of openness in columns 3, 5 and 9 is somewhat different from the estimated coefficient when the whole sample is used. In all three estimations I have excluded textiles (manufactured), since textiles is an outlier in three dimensions. The estimated coefficient in column 5 and 9 are still within the 95 percent confidence interval of the estimated coefficient in Table 4.7, the estimation in column 3 however, is not. In column 3 I have excluded the three industries with the highest level of openness as measured by export over gross output. These industries are leather (manufactured), textiles (manufactured), and mechanical engineering. Hence, apparently in these industries the effect of openness on productivity growth is less pronounced than in other industries. The textile industry is a rather extraordinary industry, since it is the most open in terms of export over gross output in the beginning of the period under consideration, it is one of the industries with the highest labour-productivity growth rate in the period, and it has a relatively small distance to the frontier.

4.5.1.1 The textiles industry and trade

In Chapter 3 I have already discussed the importance of textiles as a case study for Britain's relative economic decline. There I have shown that the textile industry was declining during the twentieth century, in the sense that the industry becomes smaller in terms of employment and output. However, although the literature has used the textile industry as a clear example of manufacturing failure, I have argued that there was not necessarily failure, since Britain could simply not compete with low wage countries. In that sense, the decline of this industry was inevitable.

In 1950 more than 85 per cent of gross output in the textiles (manufactured) sector was exported, but this share fell to only 30 per cent by 1970. Britain lost its exporting position in textiles due to fierce competition from low wage countries. At the same time however, the labour-productivity growth rate in textiles was relatively high, with an average of 5.39 per cent during the period 1951-1970. However, the size of the industry as measured by employment was falling. One of the most important changes in the textiles industry was the increasing importance of man-made fibres. Whereas by 1950 the share of man-made fibres was less than 23 per cent, by 1980 it increased to almost 70 per cent (Broadberry 1997, p.345). This process came along with significant shifts in technology. Therefore, it is possible for the textile industry to exhibit high growth rates in labour productivity, and at the same time a declining share in exports and even a decline in the size of the overall industry. Oulton and O'Mahony (1994) provide information on the increase in capital input and labour input in the textiles industry. Table 4.9 displays the annual growth rate of capital and labour input in three separate periods, and the percentage share of all sub-industries in textiles in 1951 and 1970 in terms of value added and gross output. For most industries the annual growth rate of capital input is positive, whereas the growth rate of labour input is negative. Only the carpet industry and the very small category 'other textiles industries' report positive growth rates for labour input for all three periods. The final columns of Table 4.9 display the annual change in the capital labour ratio. For all industries we observe a positive change throughout the period. Thus the capital-labour ratio increased substantially over the period, which indicates major technological change in this industry. This technological change allowed the textile industry to exhibit high growth rates. The effect of trade is less pronounced in the estimation for the obvious reason that trade was declining in the textile industry, whereas at the same time labour productivity was growing fast.

Table 4.9: Annual growth rates of capital and labour input in British textile industries (1954-1968)

	Annual growth rate of capital input			Annual Growth rate of labour input			Percentage share in total value added		Percentage share in total gross output		Annual change in K/L ratio		
Textiles (basic materials)	1954-1958	1958-1963	1963-1968	1954-1958	1958-1963	1963-1968	1951	1970	1951	1970	1954-1958	1958-1963	1963-1968
Production of Man-made Fibres	4	2.65	5.09	-0.33	-0.57	1.59	11.01	28.20	5.10	22.32	4.34	3.24	3.45
Spinning and Doubling on the Cotton and Flax System	-1.31	0.62	3.08	-6.83	-7.26	-3.27	29.38	21.65	27.77	21.79	5.92	8.50	6.56
Weaving of Cotton, Linen and Man-Made Fibres	-0.05	-0.36	0.9	-6.88	-6.72	-6.55	26.61	13.76	25.62	16.23	7.33	6.82	7.97
Woollen and Worsted	0.12	2.26	1.51	-2.08	-1.15	-4.44	28.57	32.57	37.30	35.43	2.25	3.45	6.23
Jute	3.75	-0.6	1.53	-4.15	-0.91	-3.13	1.92	2.14	2.11	2.41	8.24	0.31	4.81
Rope, Twine and Net	4.07	1.16	-0.95	-2.64	-3.49	-5.54	2.52	1.68	2.09	1.82	6.89	4.82	4.86
Textiles (manufactured)													
Hosiery and other Knitted Goods	1.35	2.74	5.98	-2.15	1.03	1.29	37.33	43.81	40.42	47.36	3.58	1.69	4.63
Lace	1.63	-0.14	-0.48	-5	-5.81	-8.74	5.46	1.96	4.91	2.08	6.98	6.02	9.03
Carpets	3.64	6.34	6.86	1.78	3.64	3.07	8.50	19.12	13.18	20.59	1.83	2.61	3.68
Narrow Fabrics	1.16	2.99	4.79	-2.13	0.14	-1.22	6.48	5.11	5.97	4.37	3.36	2.85	6.08
Household Textiles and Handkerchiefs	5.86	7.83	7.58	0.6	-0.09	-2.68	2.65	4.88	4.43	5.98	5.23	7.93	10.54
Canvas Goods and Sacks and other Made-Up Textiles	1.15	1.65	0.95	-3.56	-3.29	-4	4.84	3.23	9.19	4.11	4.88	5.11	5.16
Textile Finishing	1.79	1.96	3.69	-4.09	-4.06	-3.82	32.21	19.52	19.03	13.09	6.13	6.27	7.81
Other Textiles Industries	5.89	1.68	4.8	2.28	1.53	1.07	2.53	2.38	2.88	2.42	3.53	0.15	3.69

Source: the annual growth rate of capital input and the annual growth rate of labour input are taken from Oulton and O'Mahony (1994), table H7 and H8. The percentage share in value added and gross output is calculated on the basis of Business Statistics Office (1978), 'Historical record of the census of production 1907-1970'.

Overall we can conclude that openness appears to have had an effect on the rate of labour-productivity growth in UK industries. This result is robust to the exclusion of outlier industries.

Another potential concern in using labour-productivity growth rates is that possible outliers in these labour-productivity growth rates can have a large impact on the estimation. Due to capital utilisation, business cycle fluctuations etcetera, labour productivity may vary from year to year, and this obviously has an effect on the growth rates I calculated. To smoothen the effect of the year to year changes, I have used a three- and four-year moving average of the labour-productivity growth rate as the dependent variable in the estimations.[23] The caveat of this approach is that a few observations are lost, since it is not possible to calculate moving averages for the first and last years of the data set. This approach decreases the degrees of freedom in the estimation strategy. Table A-3.11 in the Appendix presents the results of the estimation. Although the coefficient for *YGO* is somewhat smaller than in Table 4.7, the estimated coefficients are still within the 95 per cent confidence interval of the estimates in Table 4.7. Clearly, the results are not driven by outliers in the labour-productivity growth rate. Therefore, this provides further evidence that the results are robust.

4.6 The effect of openness on Multi Factor Productivity

In this section I use Multi Factor Productivity (MFP) growth rates, also known as total factor productivity, instead of labour-productivity growth rates as the dependent variable. As discussed in Chapter 2, labour-productivity growth rates are of substantial importance when we want to make claims about the economy, since a higher labour-productivity will lead to more welfare and presumably higher livings standards. MFP growth is the ‘residual term’ in growth accounting. It measures the increase in productivity after accounting for the increase in the inputs in the production process. According to Helpman (2004, p.20) ‘*changes in MFP, which are separate from changes in inputs, represent the joint effects of all input-augmenting technological improvements and the effects of Hicks-neutral technological change*’. At the level of the individual plant we would assume that MFP is close to zero, since any increase in productivity, which is not the result from an increase in labour input or capital input, would in most cases be a one-off increase. For example, as Arrow (1962) pointed out, learning by doing

[23] The three-year moving average is calculated as the average of the observations of three time periods: $(LP_{i,t-1} + LP_{i,t} + LP_{i,t+1})/3$. The four-year moving average is calculated as: $(LP_{i,t-1} + LP_{i,t} + LP_{i,t+1} + LP_{i,t+2})/4$.

opportunities will be exhausted at some point. However, at a broader level, for example at the sectoral or industry level, MFP growth rates are usually far from zero and they explain a significant amount of productivity increases (Oulton & O'Mahony 1994). Cameron, Proudman and Redding (1997) researched productivity convergence and international openness in the United Kingdom for the period 1970-1992. Using as a measure of openness the ratio of imports over output, they estimated that the doubling of the log imports to output ratio over the period 1970-1992 was responsible for roughly 50 per cent of the increase in the estimated mean steady-state level of log-relative TFP. Cameron et al. (1997) find that international openness has a pronounced effect on productivity convergence. Hence, openness played a substantial role during the post 1970 period. However, no research is available which investigated the link between openness and total factor productivity growth at a disaggregate manufacturing level in the United Kingdom for the preceding decades. Especially the Golden Age of economic growth is a period of crucial importance. Therefore, it makes sense to perform a similar analysis for the period 1950-1970.

I use MFP data constructed by Oulton and O'Mahony (1994). Whereas many studies only provide MFP for the whole economy, or for broad sectors, Oulton and O'Mahony provide MFP growth rates at the level of the individual industry. Their estimates cover more than 130 industries, nearly all in manufacturing. The classification of industries in the MFP data set closely matches that of the official UK production censuses. I believe these estimates provide the most detailed data available. Oulton and O'Mahony followed the method of Jorgenson, Gollop and Fraumeni (1987). This approach ultimately rests on Solow (1957), who showed that under certain conditions, the growth rate of MFP can be estimated as the growth rate of output minus the growth rate of total inputs, where the latter is equal to the sum of the value -share-weighted growth rates of individual inputs. The approach relies on the assumption that producers are price takers in the output and input market, and therefore, output prices are equal to the marginal costs of production. Technology is characterised by constant returns to scale. In light of new growth theories, this method might seem old fashioned, since externalities and learning effects are not emphasised. Considering that this is the only MFP database at a disaggregate level, with a similar classification as the censuses of production, I will rely on this data to perform the analysis.

I use data on the growth rate per annum for the following periods: 1954-1958; 1958-1963; and 1963-1968. I reclassified the MFP data to match the industry classification on the import and export data.[24] The industries are weighted according to the average of the value added shares in the first and last year of the three periods.[25] Ideally one would use sectoral output shares, i.e. netting out intra-industry deliveries to weight these industries. Unfortunately this data is not readily available. Value added comes quite close to this concept and can therefore be used in the aggregation procedure. Table 4.10 presents the percentage growth in MFP per annum for the three time periods under consideration.

Table 4.10: MFP growth rates in British industry (1954-1968, % p.a.)

	1954-1958	1958-1963	1963-1968
Meat Industry	0.64	0.30	0.39
Dairy Industry	-0.19	-1.23	1.00
Fruits and Vegetables	1.90	0.68	0.27
Tobacco	-7.59	-0.67	-3.21
Beverages	-1.69	-0.60	-2.60
Leather (manufactured)	0.60	0.25	0.19
Paper	-1.12	1.43	0.07
Wood (basic materials)	2.20	0.17	-0.31
Wood (manufactured)	2.07	1.89	0.58
Leather (basic materials)	3.76	-0.42	-1.28
Non-Ferrous Metals	-2.14	2.15	1.17
Textiles (basic materials)	2.56	1.54	1.93
Rubber	-2.69	2.42	1.97
Clothing	0.27	2.00	1.51
Footwear	1.23	1.73	1.81
Iron and Steel	-2.06	0.87	1.77
Electrical Equipment	-0.92	1.99	1.93
Mechanical Engineering	-1.27	1.64	1.21
Chemicals	1.58	2.71	1.89
Textiles (manufactured)	1.03	0.91	1.67
Transport Equipment	-1.30	2.30	2.24
Optical and Precision Engineering	-1.67	2.74	2.00

Sources: own reclassification based on MFP growth rates from Oulton and O'Mahony (1994), Table H.11, pp. 282-284; Value added is taken from Business Statistics Office (1978), '*Historical Record of the Census of Production 1907-1970*'.

[24] The reclassification is similar to the reclassification of gross output, value added and employment, see Table A-3.6 in the Appendix for the details.

[25] i.e. for the period 1954-1958 the average gross output weight of 1954 and 1958 is taken to weight all industries. The benefit of this approach is that I rely on values given in the census, and I do not need to rely on interpolated values of gross output.

The period 1954-1958 is characterised by negative MFP growth rates, especially in important and relatively large industries such as engineering. Between 1958-1963 all industries in the sample, except some food branches and the leather (basic materials) industry, report positive MFP growth rates. This trend of positive MFP growth continues in the last period under consideration.

I begin my analysis by ranking the 23 manufacturing industries by the period average level of openness. I have used the sum of exports and imports over gross output to rank industries from most open to least open. Tables 4.11 shows the ranking and the corresponding *MS, XGO* and MFP values. I have split the sample in two subsamples, were the first consists of industries which exhibit a relatively high level of openness, and the second consists of groups that display a relatively low level of openness. The unweighted average total openness measure for the 'high openness' group is 0.71, and the average annual MFP growth rate for this group is 0.70. When we consider the 'low openness' group, we see that the total openness measure is 0.19 and the average annual MFP growth rate is 0.51. This result indicates that apparently industries which are more open exhibit higher MFP growth rates. We see that the *MS* and *XGO* measure are also higher for the most open group. Obviously, this merely 'eyeballing' of the table does not provide enough evidence to conclude that more open industries have higher MFP growth rates. Therefore, I will also conduct an econometric analysis.

Table 4.11: Average levels of openness and MFP growth in British manufacturing (1954-1968)

	Openness	MS	XGO	MFP
	Openness: high			
Fruits and vegetables industry	1.25	0.55	0.04	0.88
Meat industry	1.07	0.51	0.02	0.43
Leather and fur (manufactured)	0.96	0.48	0.47	0.33
Non-ferrous metals (manufactured goods)	0.73	0.39	0.23	0.57
Dairy Industry	0.70	0.40	0.03	-0.14
Wood (basic materials)	0.63	0.38	0.00	0.58
wood (manufactured)	0.60	0.37	0.04	1.47
Textiles (manufactured)	0.57	0.22	0.40	1.22
Leather (basic materials)	0.49	0.32	0.04	0.47
Optical and precision engineering	0.42	0.18	0.26	1.22
Machinery	0.41	0.12	0.31	0.65
Average	*0.71*	*0.36*	*0.17*	*0.70*
	Openness: low			
Paper (manufactured)	0.35	0.23	0.06	0.22
Chemicals	0.27	0.10	0.17	2.09
Textile fibres (basic materials)	0.25	0.17	0.06	1.97
Transport equipment	0.22	0.03	0.19	1.25
Electrical machinery	0.21	0.05	0.16	1.14
Iron and steel (manufactured)	0.15	0.05	0.11	0.35
rubber (manufactured)	0.15	0.02	0.13	0.80
Footwear	0.14	0.07	0.07	1.62
Clothing	0.13	0.07	0.06	1.33
Beverages	0.12	0.04	0.08	-1.62
Tobacco	0.10	0.08	0.02	-3.55
Average	*0.19*	*0.08*	*0.10*	*0.51*

Source: own calculations based on MFP growth rates from Oulton and O'Mahony (1994), Table H.11, pp. 282-284; Import and export values are taken from various volumes of the '*Report on overseas trade*' published by the Board of Trade. Data on gross output is taken from Business Statistics Office (1978), '*Historical Record of the Census of Production 1907-1970*'.

I estimate a fixed-effects regression, were the MFP growth rate is the dependent variable, and *MS*, *XGO* and *DTF* are explanatory variables.[26] I use the beginning values of *XGO*, *MS* and *DTF* for each of the three periods in the data set as explanatory variables to avoid endogeneity problems. It is important to include a measure of the distance to the frontier, since the previous analysis revealed that

[26] The Hausman test indicated that fixed effects instead of random effects should be used.

this distance has a large impact on productivity growth rates. One problem is that there is no MFP data for the United States available at a similar disaggregate level as for the United Kingdom. Due to difference in industrial classification I do not attempt to evaluate the gap between MFP levels in the United States and the United Kingdom. I instead use the gap in the labour-productivity levels in the United Kingdom and the United States as a control for the distance to the frontier.

I include time effects, since it might well be that in certain periods economic shocks affected all industries. Table 4.12 presents the results. The regression in column one shows the baseline estimation. In columns 2 till 7 I excluded each time three industries, which were outliers in one dimension.

Table 4.12: Fixed effects estimation results (1954-1968)

Dependent variable: average MFP growth rate

	1	2[a]	3[b]	4[c]	5[d]	6[e]	7[f]
XGO	-0.024 (0.042)	-0.141 (0.043)	-0.015 (0.039)	-0.098 (0.248)	-0.016 (0.043)	-0.022 (0.043)	-0.018 (0.043)
MS	0.145** (0.066)	0.157* (0.076)	0.0134* (0.068)	0.143* (0.072)	0.129 (0.075)	0.152* (0.075)	0.152* (0.082)
DTF	0.013** (0.005)	0.010** (0.005)	0.015** (0.007)	0.013** (0.005)	0.009* (0.004)	0.013** (0.005)	0.009** (0.004)
Constant	-7.021*** (2.009)	-5.772*** (1.883)	-7.545*** (2.484)	-6.404* (3.553)	-4.904** (1.861)	-7.908*** (2.228)	-5.693** (2.110)
F-test (p-value)	5.79*** (0.002)	5.10*** (0.004)	3.89** (0.015)	5.12*** (0.004)	4.95*** (0.005)	5.84*** (0.002)	5.18*** (0.004)
R-squared	0.652	0.510	0.642	0.657	0.508	0.639	0.414
N	66	57	57	57	57	57	57
Year dummies included	yes	yes	yes	yes	Yes	Yes	Yes

Results of time and fixed effects are suppressed. The reported R-squared is obtained by performing a dummies regression. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

a) The three industries with the highest average value of *MS* (fruits and vegetables; meat; leather (manufactured) are excluded.
b) The three industries with the lowest average value of *MS* (rubber; transport equipment; beverages) are excluded.
c) The three industries with the highest average value of *XGO* (leather (manufactured); textiles (manufactured); mechanical engineering), are excluded.
d) The three industries with the lowest average value of *XGO* (meat; tobacco; wood (basic)), are excluded.
e) The three industries with the highest MFP growth rate (chemicals, textiles (basic) and footwear) are excluded.
f) The three industries with the lowest MFP growth rate (tobacco; beverages; dairy industry) are excluded.

The estimated coefficient for *MS* in the baseline estimation is 0.145, which implies that a one unit change in *MS* will lead to a 0.145 unit change in the average annual MFP growth, keeping all else the same. The estimated coefficient for *DTF* is also positive and statistically significant. The estimated coefficient of *XGO* is not statistically significant.

The estimated coefficients for *MS* and *DTF* in columns 2 till 7 are all within the 95 per cent confidence interval of the estimated coefficient in column 1. Hence, the result is not driven by a few outlier industries. In specification 5 the coefficient of the *MS* measure is no longer significant at the ten per cent level, but it is at 10.3 per cent, which I think we can still accept as statistically significant given the small size of the sample.

Interestingly, the import measure of openness is significant in almost all of these estimations, whereas the export measure of openness does not appear to be significant at conventional significance levels. This is different from the result found in the previous section when the labour-productivity growth rate was used as the dependent variable. This might indicate that for MFP growth the competition effect is very important. To enable comparisons between the results when labour-productivity growth rates and MFP growth rates are used, I also performed the estimation on the period average growth rate of labour-productivity for the period 1954-1968. Table 4.13 below shows the results. In column 1 the baseline equation is estimated, and in the other columns outlier industries are excluded. In these estimations both the measure of openness using imports and exports are significant and have the expected positive sign. The magnitude of the effects also appears to be higher when labour-productivity growth rates are used instead of MFP growth rates. The estimated coefficient of the export measure of openness closely resembles the coefficient is of the same magnitude as the baseline estimation in table 4.7. The estimated coefficient for the measure of the distance to the frontier is not significant at conventional significance levels in the baseline estimation. However, the estimated coefficient is significant at the 14 per cent significance level, which given the small time dimension of the data set could still be seen as indicating significance. Similar to the finding in table 4.7, we also find in this estimation that when the textiles (manufactured) industry is excluded from the estimation, the estimated coefficient of *YGO* increases considerably.

In conclusion, I find that openness also has a significant effect on MFP levels during the period 1954-1968. However, the effect of openness on MFP is of a different magnitude than the effect on labour-productivity. This result further strengthens the conclusion that Britain’s relatively weak openness and trade have contributed to its relative economic decline.

Table 4.13: Fixed effects estimation results (1954-1968)

	Dependent variable: *LP* growth						
	1	2[a]	3[b]	4[c]	5[d]	6[e]	7[f]
YGO	0.388**	0.322**	0.411**	0.738**	0.367**	0.334***	0.346*
	(0.144)	(0.129)	(0.155)	(0.298	(0.150)	(0.929)	(0.167)
MS	0.769***	0.861***	0.761***	0.697**	0.838**	0.682**	0.596**
	(0.219)	(0.224)	(0.224)	(0.246)	(0.244)	(0.307)	(0.216)
DTF	0.0153	0.015	0.012	0.019**	0.012	0.0215**	0.016
	(0.101)	0.129	(0.015)	(0.009)	0.014	(0.008)	(0.010)
Constant	-0.163***	-0.149**	-0.178**	-0.165***	-0.157**	-0.162**	-0.108*
	(0.058)	(0.063)	(0.073)	(0.053)	(0.066)	(0.057)	(0.062)
F-test (p-value)	24.60	32.90	23.15	24.26	22.66	42.68	17.88
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
R-squared	0.663	0.675	0.671	0.667	0.651	0.626	0.691
N	69	60	60	60	60	60	60
Year dummies included	yes	yes	Yes	Yes	Yes	Yes	Yes

Results of time and fixed effects are suppressed. The reported R-squared is obtained by performing a dummies regression. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

a) The three industries with the highest average value of *MS* (fruits and vegetables; meat; leather (manufactured) are excluded.
b) The three industries with the lowest average value of *MS* (rubber; transport equipment; beverages) are excluded.
c) The three industries with the highest average value of *XGO* (leather (manufactured); textiles (manufactured); mechanical engineering), are excluded.
d) The three industries with the lowest average value of *XGO* (meat; tobacco; wood (basic)), are excluded.
e) The three industries with the highest *LP* growth rate (wood (basic materials); chemicals; oils and greases) are excluded.
f) The three industries with the lowest *LP* growth rate (leather (basic materials); iron and steel; mechanical engineering) are excluded.

4.7 European integration and the dismantling of the British empire

The previous sections have demonstrated that international trade is an important determinant of the growth rate of labour-productivity in Britain during the 1950s and 1960s. With use of econometric techniques I have shown that labour-productivity growth rates could have been substantially higher if there had been more trade. Moreover, I found that openness also had a pronounced effect on rates of MFP growth. In the previous investigation I used aggregated imports and exports. In this section I will zoom in on the origin and destination of trade. The literature review already touched upon some of the main critiques on British trade policies in the literature. One of the most important points of critique is that Britain was not trading with the right countries. Moreover, the literature emphasises that Britain was too late in acquiring membership of the European Economic Community, and this might have severely hampered British productivity growth in manufacturing industries (see e.g. Broadberry and Leunig 2013; Supple 1994). The aim of this section is to delve deeper into the question of whether Britain made a mistake by not joining the European Economic Community at the start, and by sticking to trading with the Sterling Area and the Commonwealth.

The first part of this section will be of a descriptive nature, I will investigate in detail how the trade pattern of Britain was shaped during the Golden Age. I will investigate with which countries Britain was trading. In the second part of this section, I will employ econometric techniques to examine what the effect of trade with various parts of the world was on labour-productivity growth in British manufacturing industry.

4.7.1 Does the geographical dimension of trade matter?

It is well established in the literature that firms that are more active in importing and exporting are more productive. A large literature has researched the effect of imports of goods with different characteristics. As described earlier, importing goods with embodied technology can be beneficial for learning by doing. Another question is to what extent the geographical dimension of trade matters. The geographical dimension of trade may distinguish for example between advanced and developing countries, or between proximate and remote countries. Research by Castellani, Serti and Tomasi et al. (2010) on Italian firms for the period 1993-1997 suggests that imports from advanced countries are associated with higher productivity premiums than imports from developing economies. This explanation suggests that imports from high-income countries are of higher quality and are more technology intensive than imports from developing economies. If firms want to use these imports they need a certain amount of absorptive capacity, which is associated with the existence of a productivity premium. Although this study focuses on the firm level, whereas I focus on the industry level, it provides evidence that the geographical dimension of imports can affect productivity.

The positive effects of exports on productivity can also be expected to differ between destination countries. De Loecker (2007) mentions that productivity improvements resulting from learning will be higher if the destination country is highly developed. When firms are exporting to developed countries, they have to compete with or supply to firms that operate close to the technology frontier and use the latest vintage of capital goods and best practise management to produce.

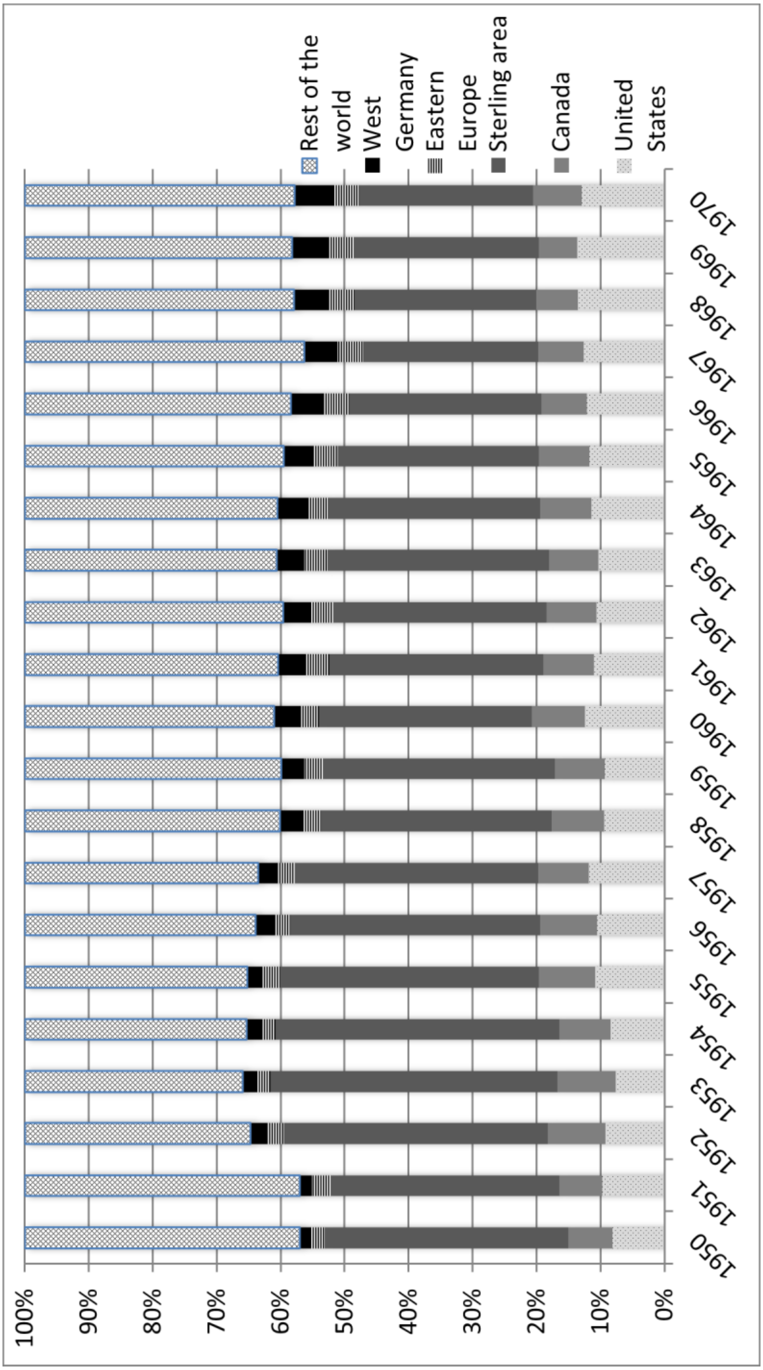
The Board of Trade published the results of an Inter-Departmental Working Party Survey on the export trend of the United Kingdom in 1957 (Wells 1964). The conclusion of this survey was that approximately one quarter of the decline the UK share of world manufacturing trade between 1951-1955 was the result of an unfavourable commodity/area pattern of trade. The changes in area pattern were found to be more significant than changes in the commodity structure of trade. Thus, according to these results, Britain lost by exporting to the wrong countries. This brings me to the question relevant for my research: does geographical origin of trade matter for the effect on labour-productivity growth rates at the disaggregate manufacturing sector?

One important point of critique in the literature is that Britain’s ties with the Commonwealth were too strong, and that this resulted in less trade with more developed countries. The Commonwealth is a group of countries that fell under the Sterling Area. The Sterling Area was unofficially formed after the economic crisis of 1929-1933 when many countries abandoned the gold standard. A large group of these countries decided to stabilise their currency with respect to the value of the British Pound Sterling. Most of the countries in this group already had strong historical linkages with Britain, and most countries traded intensively with Britain (Schenk 2010). Initially the Sterling Area was not a formal group, in 1947 membership was officially defined in the Exchange Control Act. The Sterling Area consisted of all members of the Commonwealth, except Canada and Newfoundland, all British territories, Burma, Iceland, Irish Republic, Jordan, Kuwait and the other Persian Gulf Sheikhdoms, and Libya. Most of the currency reserves of these countries was carried in Sterling. There were, with some exceptions, no exchange restrictions between the members of the Sterling Area. According to Gaitskell (1952) the most significant feature of the Sterling Area was the so-called Sterling-Dollar pool. All countries in the area, except South Africa, pooled their dollar earnings and drew on this pool for their dollar requirements. Even more remarkable was that this whole process functioned without any definite central control, but only on the basis of contracts between central banks. The two world wars and the severe crisis of the 1930s had a particularly debilitating effect on the UK's balance of payments (Mansell 1980). Imports sharply increased and exports restrained and a large proportion of production was devoted to the war effort. However, also in the post-war period Britain was plagued by problems with the balance of payments. After many years of austerity private consumption increased and so did investment. During the recovery period imports grew faster than exports (Mansell 1980). During the Bretton Woods period there were two major devaluations of sterling. The first was in 1949, the second in 1967. The devaluation on September 18 1949 was a substantial devaluation from a US Dollar/Pound Sterling rate of 4.00 to 2.80. Many of the Sterling Area members followed this decision promptly, which led to 28 devaluations in total. The French Finance Minister Maurice Petsche was afraid that this 30.5 per cent devaluation was too extreme and this would lead to a trade war for competition in international markets (Banking, 1968). However, the effect of this devaluation was short lived since the Korean War in the beginning of the 1950s led to skyrocketing prices. Due to the increase in the price of imported goods Britain witnessed again a massive increase in the visible trade deficit (Mansell 1980). The resulting increase in imports and the rise in prices reached a peak in 1951 (Briscoe 1975). In 1967 Sterling was devalued again, from US Dollar/Pound Sterling rate of 2.80 to 2.40. The Sterling Area went into decline already before the 1967 devaluation. Whereas in 1964 still 83 per cent of the official reserves of overseas Sterling area countries was Sterling, by 1967 this was only 65 per cent (Schenk 2010). Moreover, some countries left the Sterling parity during the 1960s.

I use data on trade from five areas in this analysis. The first is the Sterling Area. The second area I focus on is the United States, being the technology frontier of the world. The third area I use consists of Eastern European countries. I use trade with Eastern Europe since this is a relatively underdeveloped region. The fourth region is Canada. Trade with Canada is included since Canada and the United Kingdom are historically related with extremely close ties. The fifth and final region is West Germany. Trade with West Germany is included since this was the fast growing country at Europe's mainland in the 1950s and 1960s. Finally, the last group consists of 'the rest of the world'. I have constructed a data set on country/area-shares in Britain's total exports and imports for the period 1950-1970. I used value data in current prices as published in the report of overseas trade. Figure 4.1 and 4.2 show the geographical composition of Britain's imports and exports respectively. The graphs show the share of imports and exports from and to the United States, Canada, the Sterling Area, Eastern Europe, Western Germany, and the rest of the world as a share of total imports and exports. On the import side, we can observe that West Germany and the United States became more important as suppliers of the United Kingdom over the course of the Golden Age. Whereas in 1950 less than two per cent of imports of manufactured goods came from West Germany, by 1970 this increased to over six per cent. The importance of the Sterling area decreases gradually. In 1950, almost 40 per cent of all imports in the manufacturing industry came from the Sterling Area, and by 1970 this was only 27 per cent.

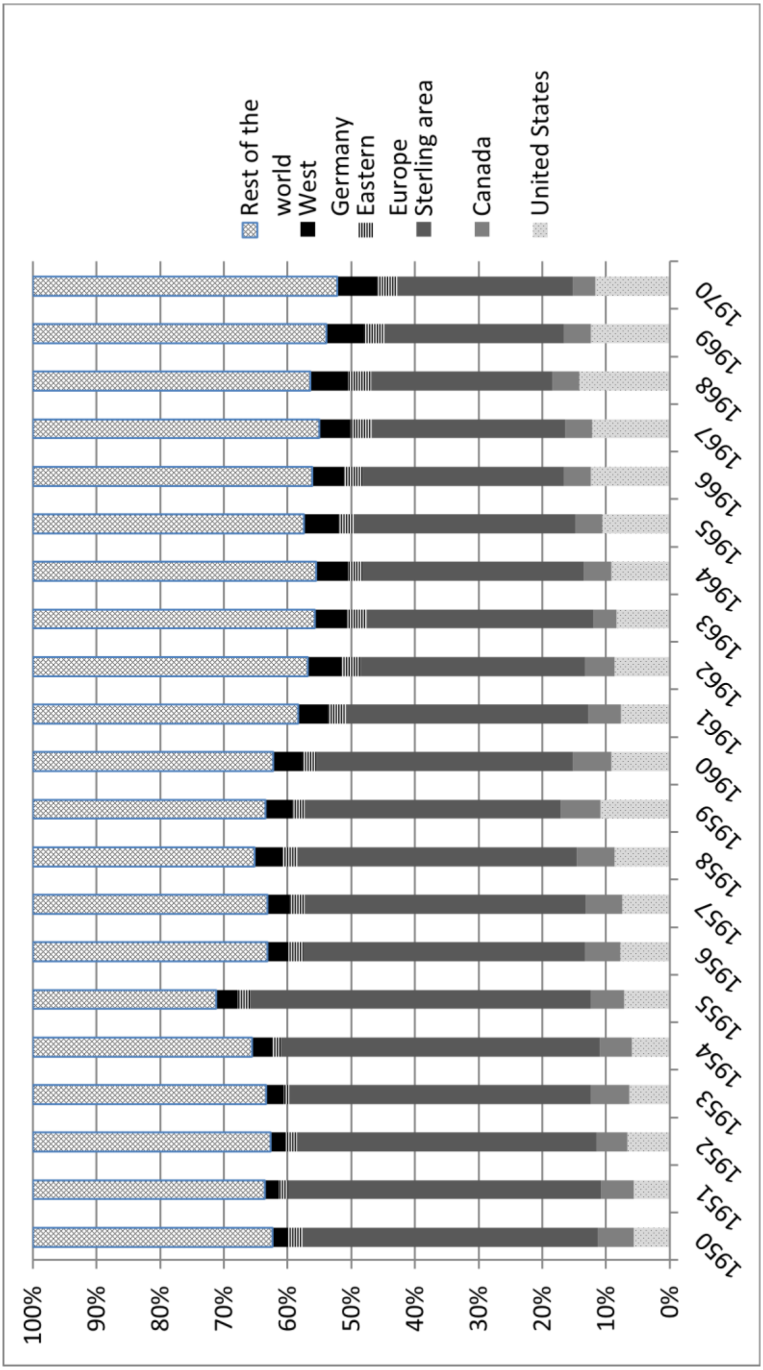
On the export side, we observe that the US share in British exports more than doubled over the course of the 1950s and 1960s. The share of exports going to West Germany also increased. The Sterling Area became much less important as a market for British exports over the course of the Golden Age. Whereas almost half of all exports in 1950 were designated to the Sterling Area, by 1970 this share has fallen to just over a quarter. Thus, there is a clear shift in Britain's trade pattern over the course of the Golden Age. Britain started to trade less with the Sterling Area, and more with the highly developed countries such as the United States and West Germany.

Figure 4.1: The geographical composition of British imports (%) (1950-1970)



Source: own calculations based on various volumes of the 'Report on overseas trade'.

Figure 4.2: The geographical composition of British exports (%) (1950-1970)



Source: own calculations based on various volumes of the 'Report on overseas trade'.

4.7.1.1 A closer investigation into Britain's area composition in trade

I use the labour-productivity growth rates as calculated in Section 4.3.2 to measure to what extent trade with different geographical areas affects productivity. This data is available for 23 manufacturing industries. I use shares of total imports and exports from various countries/regions as explanatory variables drawing from the sources mentioned in Section 4.3. Unfortunately, the disaggregated regional data which provide information on the industry level are less complete than the aggregated data. Therefore, I can only use 12 industries with information on imports, and 13 industries with information on exports. There is overlap in industries for these two groups. Tables A-3.12 and A-3.13 in the Appendix display the share of exports coming from the Sterling Area, the United States, Canada, Eastern Europe and the rest of the world, as a share of total exports for the years 1950, 1955, 1960, 1965 and 1970. West Germany is not included in this regional division, since there was no disaggregated information available for the whole period under consideration. Although merely 'eyeballing' the evolution of trade shares to the different regions over the period is obviously not a sufficient means for drawing any conclusions on the effect of trade with different geographical regions, tables A-3.12 and A-3.13 do suggest that Britain's trade pattern evolved over the course of the Golden Age, and its traditionally important trade partners became less important. Figures 4.1 and 4.2 revealed that the Sterling Area became less important as a trading area over the course of the Golden Age. However, this process is not the same for all industries. For the chemical industry for example, the Sterling Area was almost equally important as a market for exports in 1970 as in 1950. Also in the electrical engineering industry the importance of the Sterling Area did not decrease much. However, in the majority of industries the position of the Sterling Area as most important export region was lost by 1970. This process was gradual for most industries. When we shift the focus to imports we observe that the Sterling Area was a crucial partner for the leather and textiles industry. Although the share of imports from the Sterling Area in these industries declined over time, by 1970 still a respectable share originates from there. The Sterling Area also remained an important supplier of goods in the food industries.

The United States became a more important market for exports over the course of the 1950s and 1960s. Especially the share of exports in engineering industries destined for the United States increased rapidly. Whereas in 1950 only 1.21 and 0.58 per cent of all exports in respectively the mechanical engineering industry and the electrical engineering industry went to the United States, by 1960 the shares increased to 6.90 and 5.41 per cent, and finally by 1970 it reached 9.73 and

6.91 per cent. The United States became also an important partner for imports, especially in the tobacco, iron and steel, chemical and mechanical engineering industries. The share of imports from the United States in these industry has increased somewhat in 1970 as compared to 1950.

Canada was traditionally an important export market for the United Kingdom in the non-ferrous metals industry, but this position was lost by 1970. In 1950 the most important imported goods from Canada were in the wood (basic materials) industry, by 1970 the dependency on Canadian wood and paper increased quite substantially. The importance of the Eastern European countries as a market for British exports also increased. Whereas in the beginning of the 1950s this area was relatively unimportant for most industries, by 1970 its importance increased, especially in the textiles and clothing industries, and in the chemicals and leather industry.

In order to investigate whether the geographical origin of imports has an effect on labour-productivity, I performed a two-stage least square instrumental variable regression. This approach is similar to the approach in Section 4.4. I use the same underlying procedure for the measures of openness. However, whereas in the previous analysis the measures of openness were based on imports and exports from and to the whole world, I now calculated the import share of home sales, and the export share of gross output from and to specific regions. Table A-3.14 in the Appendix presents the pairwise correlations of the export measure of openness for the four regions in this study. The correlation between the share of gross output which is exported to the United States and the share of gross output which is exported to Canada is 0.848, which implies that we cannot use these two variables at the same time in a regression since this will lead to problems of multi-collinearity. The correlation between the share of gross output being exported to Canada, and the share being exported to the Sterling area is also highly correlated. Hence, I will estimate four separate equations, where I include only one region per estimation. The pairwise correlations for the import measure of openness are less high than for the export measures. Only the correlation of the import measure from Canada and Eastern Europe is higher than 50 per cent.

The distance to the frontier is included as a control variable in all these estimations. For ease of presentation, Table 4.14 only shows the estimated coefficients for the export measure of openness for the four regions.[27] I have excluded the optical and precision engineering industry, since there were missing

[27] In all these estimations the estimated coefficient of the distance to the frontier entered as expected positive and statistically significant.

values for the first years. I have also excluded the transport industry, since this appeared to be a clear outlier in the estimation. The labour-productivity growth rate of the transport sector is very volatile, which is problematic in this small sample.

Table 4.14: Instrumental variable estimation for separate geographical regions

Estimated coefficient	
YGO-US	1.667** (0.840)
XGO - Sterling	0.084 (0.168)
XGO - Canada	0.315 (1.26)
XGO – Eastern Europe	1.281 (3.286)

Robust standard errors in brackets. Results of time fixed effects and industry dummies are suppressed.

Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

I find that the estimated coefficient for the share of gross output exported to the United States is positive and statistically significant. The estimated coefficient indicates that if the export share in gross output would increase by one unit, the change in the labour-productivity would be 1.67 units, keeping everything else constant. This effect is larger than the effect I found in Table 4.6, where export to the whole world was considered.

The estimated coefficients for the share of gross output designated to the other three regions in not significant at conventional significant levels. Hence, exports to the United States seems to make a bigger impact on labour-productivity growth rates than exports to the other three regions. This is in line with the expectation. Firms, and industries, which export to the United States face competition from local firms that operate in a well-developed technological regime. Hence, in order to be able to compete with these firms, a certain productivity level is required. This finding strengthens the idea that Britain's relative economic decline is partly the result of its trading policies. By sticking to traditional trading patterns, the developed markets remained a relatively small customer for the United Kingdom. Opening up to exports to developed countries could have led to an innovation push for British companies. Therefore, I believe that it might have been more beneficial to become a member of the European Community in a much earlier stage, rather than sticking to Commonwealth trade. This finding also implies that scholars, such as Panić and Seward (1966) and Wells (1966) who already in the 1960s argued that Britain could have benefitted from trading more with well-developed countries made a valid point. My analysis provides quantitative evidence in support of their claims.

A similar analysis with the import measures of openness did not produce any statistically significant coefficients. However, this might well be the result of the limited size of the data set. Theoretically, we would assume that imports from more advanced countries would exhibit more options for learning. Moreover, to be able to use advanced inputs a certain technology level is required.

4.8 Conclusion

Britain was once the workshop of the world, and the leading trading country. However, after the Second World War Britain no longer held this position. Many hypotheses have been put forward in the literature on Britain's relative economic decline to explain the relatively poor economic performance of Britain in comparison to other developed countries, such as West Germany. Britain's trade performance might be one of the reasons for its disappointing slow growth. One of the main issues related to trade and openness mentioned in the literature is Britain's failure to become a member of the EEC at start-up. Britain relied on trading with the Commonwealth and set up the EFTA, but both trade groups did not contain advanced nations which would normally provide direct competition for British manufacturing industries. The result was that Britain remained relatively shielded from competition in the period after the Second World War. This isolation from competition might have resulted in a lower innovation push in British manufacturing, and hence lower labour-productivity growth rates and lower MFP growth rates. Moreover, relatively low levels of export could also lead to fewer opportunities to reap economies of scale and profit from the market size effect. The 1950s and beginning of 1960s were still characterised by high levels of protection, which frustrated imports. The first large decrease in tariffs was negotiated in the Kennedy Round in 1967, but these changes only went into effect in the following five years, and thus had no impact on trade in the first decades after the war.

In this chapter I investigated whether trade and openness had an effect on labour productivity, as measured by value added per hour worked, in a sample of 23 manufacturing industries in Britain in the post-war period. I have used different measures of openness. The first is imports as a share of domestic sales (*MS*), the second measure is the ratio of exports to gross output (*XGO*). The labour-productivity gap between the United States and the United Kingdom, as measured by value added per hour worked, is included to control for catch-up and convergence effects. To control for possible endogeneity problems (i.e. industries export more because they are more productive) I employed a two-stage least square instrumental variable approach where lagged measures of the openness variables were used as instruments. I find a positive, statistically significant coefficient for the export measure of openness. Thus, the larger the share of export in gross output, the higher the growth rate in labour productivity. This finding can be explained by the larger opportunities to reap scale economies. However, it might also be that Melitz-type of effects are at work, and openness to trade implies that the least productive firms in an industry leave the market, which results in a higher overall productivity level of the industry. The estimated coefficient of the distance to the frontier measure is in most specifications positive and statistically significant. This means that industries that are further from the technology frontier experience larger labour-productivity growth rates. This finding is as expected, and in line with the prediction of the catch-up and convergence literature.

I have also investigated the effect of openness on MFP growth rate for the period 1954-1968. The advantage of this method is that I did not need to rely on interpolated values of gross output and value added. I find that openness, and particularly imports also had a pronounced effect on MFP growth rates. This might be the result of the competition effect of imports.

In the final part of this chapter, I investigated the importance of the geographical dimension of trade. Theoretically we would assume that trade with more advanced countries is more advantageous. The analysis showed that Britain was highly dependent on the Sterling Area for both the imports and exports throughout the Golden Age, although near the end of the period the importance started to decline. The econometric analysis indicates that exports to the United States had a positive and statistically significant effect on labour productivity growth rates. This analysis suggested that Britain could have gained from being integrated in the EEC. Britain could have experienced higher labour-productivity growth rates if it had traded more with advanced countries.

This chapter provides new evidence indicating that labour-productivity growth is correlated with measures of international openness over the period 1951-1970 over a cross section of 23 industries in British manufacturing. The effect of openness on the labour-productivity growth rates is substantial. Therefore, the critique on Britain's trade policy and export performance seems to be relevant. Trade and openness should be considered as important explanations in the debate on Britain's relative economic decline.

Chapter 5

Conclusion: A reassessment of the manufacturing failure hypothesis

The concept of economic decline has since long been a research topic in the British literature. In particular the literature on the post-war era views the process of economic decline as the result of pathological failure of Britain, and not as the inevitable result of global capitalism and economic growth in other nations (Tomlinson 2009). Economic growth in the United Kingdom was unusually low during the Golden Age in comparison with other advanced nations. As the previous Chapters pointed out, this is indicating that Britain was confronted with *relative* economic decline. There is a large literature with non-mutually exclusive ideas about the causes of the divergent growth experiences during the Golden Age, ranging from institutional explanations, to macro-economic policies, and catch-up and convergence theories. The mainstream interpretation of Britain's relative decline has crystallized around the Broadberry-Crafts view and, at its core, the so-called manufacturing failure hypothesis.

Chapter 1 spelled out some important questions that need to be answered in order to clarify the ongoing debate on the causes and nature of British relative economic decline. The first question is whether there was failure in manufacturing. To answer this question I set out to find which industries contributed most to Britain's relative economic decline.

The dissertation starts with a detailed account of how relative labour-productivity in the United Kingdom and West Germany developed over the period 1935-1968. In Chapter 2 of this dissertation I have constructed a disaggregate labour-productivity benchmark for West Germany and the United Kingdom for the year 1951. I also substantially revised the existing 1935 benchmark from Fremdling et al. (2007a) in order to make it directly comparable with the post-war estimates. Finally, I relied on an existing 1968 labour-productivity estimate from Smith et al. (1982) to evaluate the relative position of the United Kingdom and West Germany near the end of the Golden Age of economic growth. These three estimates together allowed me to obtain a complete picture of Britain's relative labour-productivity performance from the interwar period to the end of the 1960s. The data reveal that West Germany had a substantial lead over the United Kingdom during the interwar period. In the years after the Second World War this pattern had completely reversed. The United Kingdom was more productive in nearly all industries. However, West Germany remained the productivity leader in the iron and steel industry. At the end of the 1950s however, West Germany managed to overtake Britain again. According to the estimate of Smith et al. West Germany was 23 per cent more productive than Britain in 1968. The period 1935/1968 is clearly a period of shifting fortunes.

In Chapter 3, I have applied shift-share analysis to examine whether the aggregate manufacturing gap in labour-productivity between the United Kingdom and West Germany was the result of intra-sector effects, or differences in industrial structure. I found that for both 1935 and 1951 the intra-industry effects were the most important driver of the aggregate gap. The structure between the two economies was not very different, and hence, not very important in explaining the aggregate gap. Thus the difference in productivity in similar industries in West Germany and the United Kingdom was driving the aggregate gap.

The great advantage of my novel and highly disaggregated labour-productivity dataset is that it also allowed me to investigate in detail what the contribution of all individual industries was to the aggregate labour-productivity gap in manufacturing. Understanding the importance of individual industries is crucial if we want to discuss whether British manufacturing failed or not. The sharp deterioration of the principal war industries in West Germany, such as iron and steel, metal products, machine tools, transport vehicles, electrical engineering and chemicals, was the reason why West Germany fell behind after the Second World War. The atypical tobacco industry was responsible for almost half of the aggregate manufacturing gap in labour productivity in 1951. Whereas Britain produced mainly capital intensive cigarettes, West Germany was still producing labour intensive cigars. As a result, British labour-productivity was much higher than in West Germany.

The second part of Chapter 3 is concerned with the causes of Britain's relative economic performance. The United Kingdom was bound to achieve more modest rates of labour-productivity growth in manufacturing because (1) the United

Kingdom was closer to the technological frontier than West Germany, and (2) because it lacked the potential for reconstruction growth that, according to many, was the engine of the German *Wirtschaftswunder*. I found a high correlation between the estimated labour-productivity gaps in 1935 and my extrapolated labour-productivity gaps for 1960. I believe that reconstruction indeed played a significant role in West Germany's fast growth rates after the Second World War. However, West Germany continued to exhibit extraordinary growth rates after the end of the 1950s, when it should be expected that West Germany was back on its long run growth trajectory. Hence, reconstruction growth can be used as an explanation for the comparatively faster growth of West Germany as compared to the United Kingdom during the 1950s. However, reconstruction growth does not explain the growth dynamics during the 1960s.

Another important contribution of this dissertation to the literature is that my new data can be used to resolve an important debate in the economic history literature. My new data and findings shed more light on the big questions concerning the economic performance of Britain, and I am able to demonstrate that some of the arguments used in the debate should be reconsidered. My conclusion on the timing of the West-German overtaking of the British labour-productivity level are different from what previously has been argued in the literature. In the 2003 debate in the '*Economic History Review*' between Booth (2003a) and Broadberry and Crafts (2003), Booth concludes that almost two-third of West Germany's relative productivity performance over the course of the Golden Age was secured by 1952. However, this calculation relied on a labour-productivity estimate by Broadberry which was extrapolated from a distant benchmark year. With use of my novel data I am able to show that this claim of Booth is highly exaggerated. I find that less than a quarter of the West-German improvement over the period 1951-1968 was secured by 1952. Hence, the remainder of the 1950s and 1960s are still of crucial importance to explain the shifting fortunes of West Germany and the United Kingdom.

The final part of Chapter 3 focused on possible underlying causes of Britain's relative economic decline, such as failure in Americanisation and mass production techniques, and human capital. Due to the historical commitment of the United Kingdom to craft production, attempts to switch to mass-production techniques were resisted by the shop floor workers. British managers were also not very eager to adopt these methods since they had no experience with the type of shop floor control needed to operate these methods. Although after the war the Anglo-American Council on Productivity was set up to promote American production techniques in the United Kingdom, the effect of this organisation was very limited. I have constructed so-called manufacturing footprints to evaluate whether large plants in British industry had a different productivity than the average level in the industrial branch. The new data have revealed that in many cases the large plants were more productive than average. In that sense I can agree with the conclusion from Booth (2003a), who argued that there is not really any failure in large-scale operations.

Although there were problems in the United Kingdom related to Americanisation and mass production techniques, I do not believe we should necessarily call the British performance in this area as failure. Given the situation, the different demand structure and the historical dependence on craft production it was simply not possible to copy American techniques.

Chapter 4 focuses on the role of international trade and openness on Britain's relative economic decline. The United Kingdom was once the first major, dominant trading country of the world. After the Second World War, the United States became the biggest exporter of manufactured goods in the world, and by 1958 West Germany overtook Britain's position as the world's second largest exporter of manufacturing goods. The Golden Age of economic growth was in essence a period of protectionism in Britain, with high tariffs. According to Broadberry and Leunig (2013) an important reason for Britain's sluggish productivity growth in the post-war period, as compared with for example West Germany, was the isolation of British firms from foreign competition. European nations had relatively similar economic structures during this era, which means that firms in each country could compete with each other in a potentially vigorous manner. Britain however, was still trading with the Commonwealth, but these economies were complementary to each other, and hence intra-industry competitive pressure was lowered.

I examine at the disaggregate manufacturing level whether there was an effect of trade and openness on Britain's labour productivity for the period 1951-1970. I use behavioural measures of openness to examine the relationship between openness and labour-productivity growth. My research contributes to the debate on British failure in manufacturing by providing a detailed account of Britain's trade performance over the course of the Golden Age. The main contribution of this chapter is the quantification of the relationship between openness and productivity during the post-war era in the United Kingdom. Although the literature has mentioned Britain's trade patterns and its export performance as a cause of its relative economic decline, there is not much quantitative evidence available to support this claim. My estimations showed that indeed openness affects labour-productivity growth. Especially the level of exports has a pronounced effect on labour-productivity growth.

The second part of chapter 4 is concerned with the geographical origin of trade. The Sterling Area was still the single most important trading area of the United Kingdom in 1950. Over the course of the Golden Age the importance of the Sterling Area declined. I investigate at the disaggregate industry level whether the geographical origin of imports, and destination of exports had an effect on labour-productivity growth in manufacturing. I find that exports to the United States had a bigger impact on labour-productivity growth rates than exports to the Sterling Area, Canada and Eastern Europe. This is in line with the expectation from the theory. Firms, and industries, which exported to the United States faced competition from local firms that operated in a well-developed technological regime. Hence, in order to be able to compete with these firms, a certain minimum productivity level was required.

The second question stated in my introduction “How large were the effects of the British focus on trade with the Commonwealth nations on manufacturing labour-productivity levels?”. I found that international trade indeed had a pronounced effect on labour-productivity growth rates.

The geographical origin of trade was also relevant. Britain’s trading partners were important for the positive externalities from trade on labour-productivity growth rates. This finding implies that scholars, such as Panić and Seward (1966) and Wells (1966) who already in the 1960s argued that Britain could have benefitted from trading more with well-developed countries made a valid point. My analysis provides quantitative evidence in support of their claims. This finding strengthens the idea that Britain’s relative economic decline is partly the result of its trading policies. Therefore, I believe that it might have been more beneficial to the United Kingdom to become a member of the European Community in a much earlier stage, rather than sticking to Commonwealth trade.

Overall this dissertation has contributed to the ongoing debate on Britain’s relative economic decline during the Golden Age of economic growth. With new data I am able to show more precisely when West Germany overtook the British labour-productivity lead in manufacturing. I have also been able to pinpoint which industries contributed most to the aggregate manufacturing gap. In the second part of this dissertation I have shown that openness and trade were important for Britain’s labour-productivity growth. Hence, scholars who have identified trade as a potential cause of British decline do have a point. Future research should indeed take Britain's trading position into account.

To conclude: failure is an overrated concept in the discussion on British manufacturing. As I have demonstrated, with for example the case of textiles, there is sometimes good economic reason not to adopt novel modes of production. Therefore, I argue that we should not state that British entrepreneurs have failed. However, when we consider the economic climate and the role of government policies the situation is different. In particular when it comes to education and trade policies different decisions could have been made, such as opening up to the EEC, which might have been more beneficial for productivity in the long run.

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Appendices

Table A-1.1: The classification of industries into major industry groups and industry branches (1951)

Code	Industry Groups	Code	Industry Branches	Included industries United Kingdom	Included industries West Germany
100	Coal Mining	101	Mining	Coal Mines	Kohlenbergbau
200	Textiles	201	Textiles	Cotton Spinning and Doubling; Cotton Weaving; Woollen and Worsted; Rayon, Nylon etc. and Silk; Flax Processing; Linen and Soft Hemp; Jute; Rope, Twine, Net; Hosiery and other Knitted Goods; Lace; Carpets; Narrow Fabrics; Canvas Goods and Sacks; Made-up Household Textiles; Textile Finishing; Textile Packing; Flock and Rag; Hair, Fibre and Kindred Trades	Textilindustrie
300	Leather	301	Leather	Leather (Tanning and Dressing); Fellmongery; Leather Goods	Ledererzeugende Industrie; Lederverarbeitende Industrie
400	Clothing and Footwear	401	Footwear	Boots and Shoes	Schuhindustrie
		402	Clothing	Tailoring, Dressmaking etc.; Hats, Caps and Millinery; Glove; Umbrella and Walking Sticks; Fur	Bekleidungsindustrie
500	Iron and Steel[1]	501	Iron and Steel Furnaces	Blast Furnaces; Iron and Steel (Melting and Rolling); Steel Sheets; Tinplate	Hochofen-, Stahl- und Warmwalzwerke; Schmiede-, Press- u. Hammerwerke
		502	Iron Foundries	Iron Foundries	Eisen-, Stahl- und Tempergießereien
		503	Non-Ferrous Metals	Non-Ferrous Metals; Precious Metals	NE-Metallindustrie; NE-Metallgießereien
		504	Fabricated Metal Products	Cutlery; Hardware, Hollow-ware, Metal Furniture and Sheet Metal	Schneidwaren- und Besteckindustrie ; Schloss- u. Beschlagindustrie; Heiz-u. Kochgeräteindustrie; Blechwaren-u. Feinblechpackungsindustrie

Continuation of Table A-1.1

Code		Code	Industry Branches	Included industries United Kingdom	Included industries West Germany
600	Engineering and Vehicles	601	Vehicles	Motor Vehicles and Cycles; Carts, Perambulators, etc.	Fahrzeugbau; Fahrradteile -und Kraftradteile
		602	Mechanical Engineering	Machine Tools; Textile Machinery and Accessories; Small Arms; Construction Engineering; Mechanical Handling Equipment; Printing and Bookbinding Machinery; Mechanical Engineering (general)	Maschinenbau
		603	Electrical Engineering	Electrical Engineering (general); Electric Wires and Cables; Radio and Telecommunication; Batteries and Accumulators; Electric Lighting Accessories and Fittings	Elektrotechnische Industrie
		604	Optical and Precision Engineering	Scientific, Surgical and Photographic Instruments etc.; Watch and Clock	Feinmechanische und Optische Industrie sowie Uhrenindustrie
700	Food, Drink and Tobacco[2]	701	Grain and Milling	Grain and Milling	Mühlenindustrie
		702	Dairy Products	Milk Products	Molkereien und milchverarbeitende Industrie
		703	Cocoa, Chocolate and Sugar Confectionary	Cocoa, Chocolate and Sugar Confectionary	Süßwarenindustrie
		704	Fruit and Vegetable Products	Preserved Fruit and Vegetables	Obst u. Gemüse verarbeitende Industrie
		705	Margarine	Margarine	Ölmühlen- und Margarine-Industrie
		706	Fish Curing	Fish Curing	Fischverarbeitende Industrie

Continuation of Table A-1.1

Code		Code	Industry Branches	Included industries United Kingdom	Included industries West Germany
		707	Tobacco	Tobacco	Tabakverarbeitende Industrie
		708	Meat Products	Preserved Meat; Wholesale Slaughtering; Bacon Curing and Sausage	Fleischwarenindustrie
		709	Bakeries	Bread and Flour Confectionery	Brotindustrie
		710	Mineral Water and Soft Beverages	Soft Drinks, British Wines and Cider	Mineralwasser- und Limonaden-Industrie
800	Chemicals	801	Chemicals	Manufactured Fuel; Dyes and Dyestuffs; Fertiliser, Disinfectant, Insecticide and Allied Trades; Coal Tar Products; Chemicals (general); Drugs and Pharmaceutical Preparations; Toilet Preparations and Perfumery; Explosives and Fireworks; Paint and Varnish; Soap, Candles and Glycerine; Polishes; Ink; Match; Mineral Oil Refining; Oils and Greases; Seed Crushing and Oil Refining; Glue, Gum, Paste and Allied Trades; Plastic Materials	Chemische Industrie; Mineralölverarbeitung
900	Building Materials	901	Glass	Glass Containers; Glass other than Containers	Glasindustrie
		902	Building Materials	Brick and Fireclay; Cement; Building materials; Roofing Felts	Industrie der Steine und Erden
		903	China and Earthenware	China and Earthenware; Abrasives	Feinkeramische Industrie
		1002	Timber Industry	Timber	Sägewerke und Holzbearbeitung

Continuation Table A-1.1

Code	Industry Groups	Code	Industry Branches	Included industries United Kingdom	Included industries West Germany
1100	Paper Industry[3]	1101	Paper and Board	Paper and Board; Wallpaper; Cardboard Box, Carton and Fireboard Packing Case; Manufactures Stationery, Paper Bag and Kindred Trades	Papierverarbeitende Industrie; Holzschliff, Zellstoff, Papier und Pappeerzeugung
1200	Miscellaneous	1201	Rubber and Asbestos	Rubber; Asbestos	Kautschukverarbeitende und Asbestindustrie
		1202	Miscellaneous	Linoleum, Leather cloth and Allied Trades; Brushes and Brooms; Toys and Games; Sport Requisites; Miscellaneous Stationers' Goods; Cinematograph Film Production; Cinematograph Film Printing; Plastic Goods and Fancy Articles; Incandescent Mantles	

Notes:

1. The branch Iron and Steel for Britain also includes: Wrought Iron and Steel Tubes; Small Arms; Tools and Implement; Chain, Nail, Screw and Miscellaneous Forgings; Wire and Wire Manufactures; Needles, Pins, Fishhooks and Metal Small ware. For West Germany it includes: Ziehereien und Kaltwalzwerke; Metallwaren-u. Kurzwaren-Ind.; Werkzeugindustrie; Stahlverformung (einschl. Gesenkschmieden).
2. The Food, Beverages and Tobacco industry includes for Britain also: Biscuit; Ice Cream; Sugar and Glucose; Cattle, Dog and Poultry Foods; Vinegar and Other Condiments; Starch; Ice; Miscellaneous Preserved Foods; Brewing and Malting; Wholesale Bottling; Spirit Distilling; Spirit Rectifying and Compounding. For West Germany it includes: Nährmittelindustrie; Stärke-, und Kartoffeltrocknungs-Industrie; Futtermittelindustrie; Zuckerindustrie; Kaffeeverarbeitende und kaffee-Ersatz Industrie; theeverarbeitende industrie; Essig-, Senf-, Essenzen- und Gewürzindustrie; Eisgewinnung; Brauereinen und Mälzereinen; Spirituosenindustrie; Weinverarbeitende Industrie.
3. The Paper Industry for Britain also includes: Newspaper and Periodical Printing and Publishing; Publishers (non-printing firms); Printers Bookbinders. For West Germany is includes: Druckereien und Vervielfältigungsindustrie

Sources: Own reclassification based on Board of Trade (1954), '*The Report on the Census of Production for 1951*' and, Statistisches Bundesamt (1956b) '*Die Industrie der Bundesrepublik Deutschland, Reihe 4: Die industrielle Produktion, 1951/55'*.

Table A-1.2: Annual hours worked in the manufacturing sector in West Germany and the United Kingdom 1950

Industry	Sector	Average annual hours per person engaged, manufacturing		
		United Kingdom	West Germany	Ratio (GE/UK)
Chemicals and Allied Products	*Total*	2042	2325	1.14
	Chemicals	2027	2345	1.16
	Rubber & Plastic	2075	2257	1.09
Basic Metals & Fabricated Metal Products	*Total*	2095	2356	1.12
	Basic Metals	2137	2374	1.11
	Metal Products	2032	2313	1.14
Motor Vehicles and Engineering	*Total*	2079	2323	1.12
	Office & Mech. Engineering	2127	2420	1.14
	Mechanical Engineering	2130	2433	1.14
	Office Machinery	2077	2138	1.03
	Electrical Engineering	2007	2214	1.10
	Motor Vehicles	2062	2265	1.10
	Other Transport Equipment	2117	2378	1.12
	Instrument Engineering	1996	2321	1.16
Textiles, Clothing and Leather	*Total*	1941	2145	1.11
	Textiles	1994	2164	1.09
	Leather, Footwear & Clothing	1880	2124	1.13
Food Drink and Tobacco	*Total*	1998	2422	1.21
Other Manufactures	*Total*	1970	2432	1.23
	Non-Metallic Mineral Products	2194	2497	1.14
	Wood & Furniture	2099	2462	1.17
	Paper & Printing	2055	2368	1.15
	Miscellaneous Manufacturing	1962	2246	1.14
Mining and Oil Refining	*Total*	2259		
Total Manufacturing		2070	2327	1.14
Number of vacation and holiday days		24	29	

Sources: O’Mahony (1999), appendix Table C, pp. 96-103; data is for manual workers only.

Table A-1.3: Detailed information data sources and adjustments to data for the 1951 benchmark

Description of censuses 1951
In the British census, establishments were classified to trades according to the nature of their output. An establishment engaged in multiple activities, e.g. a firm engaged in machine-tool production and casting, was classified to a trade if the principal products of that trade accounted for a greater proportion of the value of its output than did the principal products of any other trade. Offices, warehouses, laboratories and other ancillary places of business, which were separated apart from the producing work, were not regarded as separate establishments, and the persons employed were included on the return for the works. If firms with more than one establishment were unable to make separate returns for each establishment, they were generally allowed to make one return covering all establishments in one trade. In Britain, proprietors employing an average of less than eleven people were not required to report detailed returns. However, small firms were required to provide information on the annual average number of male and female workers and the nature of their business. In trades in which the output of small firms was thought to have accounted for a relatively high proportion of the total output, small firms were required to complete a simplified form. In the German census firms active in multiple industries were placed in the industry group where the core of their business was, as measured by the number of employees engaged in production. This method of classification differs from the British method, where the value of output was used to determine the core of the business. However, it seems reasonable to expect that these methods will not deviate too much, since output value and employment are highly correlated.[a] In the German census information is provided only for those firms that employed at least ten persons. The German census provides no information when there are less than three firms operating in an industry for confidentiality reasons. **Data adjustments** In a few industries adjustments were needed in order to construct a consistent benchmark. Below the adjustments are explained in detail: - One problem in the engineering sector is that in the British census most products are quoted in numbers, whereas in the German census products are quoted in tons. Since I have no information on the products, besides a description, I cannot compare these two types of quantities. To overcome this problem I have used the British trade statistics, in which export is quoted in tons. I deducted five per cent of the value of export, since export prices are quoted f.o.b., and I want to use a proxy for ex-factory prices. Comparing tons of machines with tons of machines is still problematic, since I have no information on the quality of products, and machinery is less homogenous than other products in this comparison. Given that there is no other method of comparing that is preferable, I will use this approach. However, caution has to be taken in interpreting these results. - In the vehicle branch I was not able to match cars, since Britain provides numbers and West Germany tons of cars. I was able to match motorcycles and engines. I took the PPP from mechanical engineering as a proxy for the PPP for

Description of censuses 1951

cars, and weighted this PPP with the motorcycle/engines PPP to obtain a PPP for the whole vehicle branch.

- For footwear and leather I took the weighted average of the footwear and leather branch as a proxy for the PPP in these two branches.

Note: a). The correlation coefficient between the net value of production and the number of employees is 0.83 for West Germany and 0.97 for the United Kingdom. Both coefficients are significant at the 1 per cent level.

Sources: Board of Trade (1954), '*The Report on the Census of Production for 1951*'; Board of Trade (1951). Board of Trade (1952), '*Accounts Relating to Trade and Navigation of the United Kingdom for Each Month during the Year 1951*'. Statistisches Bundesamt (1956b) *Industrie der Bundesrepublik Deutschland*, Reihe 4, Die industrielle Produktion 1950/55; Statistisches Bundesamt (1954) *Statistisches Jahrbuch 1953*, pp. 311-4; Statistisches Bundesamt (1956f), *Aussenhandel der Bundesrepublik Deutschland*, Teil 1: Zusammenfassende Übersichten. Jahrgang 1955, Jahresheft, p. 4; Statistisches Bundesamt (1956e). *Die Industrie der Bundesrepublik Deutschland*, Reihe 4: Sonderveröffentlichungen, Nr. 12. Beschäftigung und Umsatz, Brennstoff- und Energieversorgung 1951 bis 1955. Jahreszahlen der Industrieberichterstattung; Statistisches Bundesamt (1965). Fachserie D: *Industrie und Handwerk*, Reihe 4: Sonderbeiträge zur Industriestatistik. Neuberechnung des Index der industriellen Nettoproduktion auf Basis 1958.

Table A-1.4: List of products and corresponding value of output and unit value ratios for United Kingdom and West Germany 1951

Indus. ID	Product Name	Value United Kingdom (£000)	Value West Germany (DM000)	UVR (DM/£)
101	Coal	465390	2595971	16.65
201	Carpets	61554	184155	8.15
201	Furniture fabrics	16355	235859	23.06
201	Bed covering and quilt cloth	2318	134284	22.22
201	Cotton yarn (single and doubled)	369542	1711496	11.10
201	Jute yarn	16439	44320	12.81
201	Woollen yarn	21395	776587	13.23
201	Worsted yarn	135909	531663	11.00
201	Yarn of flax and ramie	2377	59381	16.10
201	Yarn of soft hemp	840	163551	10.56
201	Sewing, hand knitting yarn	20158	470688	13.72
201	Woven cotton cloth	256639	1257604	4.96
201	Woven wool cloth	60418	1203659	16.66
301	Upper leather - calf	15449	102000	16.72
301	Upper leather sheep/goat	1466	46223	20.98
301	Upper leather other	65094	283790	5.13
301	Gloving leather	4511	26945	14.79
401	Working shoes and sporting shoes	12039	134834	24.80
401	Leather street shoes	120641	1069740	15.66
401	Sandals, slippers, surgical shoes	18793	179371	11.55
401	Woodwork shoes	160	1590	7.56
402	Men’s' and boys - suits	46612	270111	13.35
402	Men’s' and boys - jacket	51284	328623	31.41
402	Women’s and girls’ - suit	22207	19884	31.11
402	Women’s and girls’ - jacket	40955	352123	13.30
402	Women’s and girls’ - skirts and trousers, shorts	25783	19451	6.33
402	Women’s and girls’ - blouses	11559	52639	10.32
402	Women’s and girls’ - dresses	41781	148291	13.06
402	Work/service clothing	9997	138695	5.26
402	Men’s' and boys underwear - shirts	33191	277199	12.86
402	Men’s' and boys underwear - nightwear	9113	32553	24.29
402	Women’s' and girls and children- apron	3774	24399	18.71
402	BH	4627	44554	9.71
402	Corsets	9478	42187	13.91

Indus. ID	Product Name	Value United Kingdom (£000)	Value West Germany (DM000)	UVR (DM/£)
402	Hats of wool felt	6278	47244	23.32
402	Hats of fur felt	5855	53985	16.11
402	Caps (including uniform)	2141	25027	13.77
402	Umbrella	1600	37406	11.62
402	Scarfs	466	14154	3.62
402	Ties	1334	33510	9.55
402	Dressed skins	1312	5012	4.97
402	Dyed skins	916	8223	4.36
402	Fur coats	3279	20785	10.14
501	Tinplate and cushion	42101	183484	11.36
501	Steel sheet (thick)	46078	372196	13.02
501	Sheeting and cushion, galvanised and leaded	8229	122177	16.36
501	Steel bars	162540	932708	12.98
501	Pig iron incl. blast furnaces and ferroalloy	119216	1711984	13.14
502	Iron casting	27538	1473623	5.00
503	Aluminium	41490	18648	15.00
503	Aluminium alloy	16604	16330	14.07
503	Copper	69872	1149834	17.89
503	Lead	33872	463622	10.59
503	Tin	40426	37168	13.96
503	Zinc dust	2153	12917	9.13
503	Zinc	11734	255213	10.93
504	Razors	1446	1860	6.03
504	Scissor (small)	364	18950	13.11
504	Scissor (large)	481	3990	13.61
504	Railway rail	11029	153648	14.58
601	Motor cycles (including auto cycles, miniature motor cycles and motorised bicycles)	16063	452656	8.06
601	Combustion engines	21905	107877	6.67
602	Refrigerator machines	31179	3852	12.97
602	Gas compressor	1297	93584	9.45
602	Machines for preparations for spinning	13632	44394	14.35
602	Textile machinery (other)	24528	155088	11.20
602	Preparatory machines for weaving	3674	37390	11.84
602	Looms and other weaving machines	9208	30290	8.80

Indus. ID	Product Name	Value United Kingdom (£000)	Value West Germany (DM000)	UVR (DM/£)
602	Knitting machines	6809	67356	8.69
602	Sewing machines	9282	258150	25.73
602	Paper making machinery	7160	162931	12.59
602	Boring machines	685	71910	12.59
602	Rolling mill (metal working) machinery	7093	101853	12.80
602	Steam turbines	10765	79287	11.55
602	Water turbines	1310	34961	17.39
602	Air compressors	4510	93584	14.19
602	Cement making machinery	934	16737	18.28
602	Milking machines	2267	14300	10.18
602	Sugar making and refining machinery	2926	34207	16.91
602	Tobacco, cigar and cigarette-making machinery	3895	10535	8.80
602	Gas and chemical machinery	25300	86046	17.74
602	Water softeners, water filters, and water sterilizing equipment	2368	4894	13.51
602	Washing/laundry machines	5784	40775	10.93
602	Sweet making machinery	1542	17584	15.40
602	Boots and shoe making machinery	2245	36039	9.84
602	Centrifugal pumps	10808	43930	13.26
602	Disc harrow	770	2732	10.65
602	Earthmoving machines	1154	12755	7.09
602	Threshers	474	53409	10.37
602	Insecticide sprayers and similar machines	651	13784	7.16
602	Ploughs	2492	37968	7.26
602	Potato harvest machine	253	12305	7.67
602	Planters, drills and seeders	1241	14194	7.86
602	Addressing machine (office)	805	7420	4.85
602	Typewriters	4177	122092	16.72
602	Calculators (office)	2262	38182	10.49
602	Accounting and bookkeeping machines	3300	56540	3.79
603	Generators	14971	759000	12.00
603	Batteries and accumulators	31916	124415	17.05
603	Radio receiving sets	14382	419661	19.77
603	Light bulbs	10092	80768	24.34
604	Wrist and pocket watch clocks	2619	109746	16.33
604	Clocks	5035	108442	10.05

Indus. ID	Product Name	Value United Kingdom (£000)	Value West Germany (DM000)	UVR (DM/£)
604	Eyeglasses (of all kinds)	1962	22608	10.08
701	Wheat and flour	102590	1348754	26.08
701	Semolina	1376	55727	18.90
701	Bran	18751	145911	11.62
701	Oatmeal, oat flakes	7217	33347	18.20
702	Milk powder full cream	4272	42168	6.68
702	Milk powder skimmed	441	10779	6.34
702	Milk bottled	142357	21338	7.56
703	Cocoa powder	5158	28083	14.76
703	Cocoa butter	2691	29322	9.37
703	Chocolate bars	33781	522680	3.21
703	Sugar confectionary	48549	270060	12.35
704	Fruit conserves	7396	25883	6.78
704	Vegetables conserves	21172	116627	12.57
704	Marmalade, jams and jellies	32727	98352	10.53
705	Margarine	1253	918605	16.92
706	Fish	11745	235931	13.36
707	Cigarettes	24733	762605	19.66
707	Cigars	68	362084	5.05
708	Preserved meat	12703	147918	12.98
709	Flour confectionary	45321	35802	16.41
710	Mineral water and soft drinks	29593	63150	9.51
801	Dilution, oil paint and synthetic paint	8707	279064	12.09
801	Water based paint and oil based paint	46147	2390	6.11
801	Nitrocellulose, synthetic resin	8457	166173	12.35
801	Other paints, varnish and coating	21677	117753	7.58
801	Putty	1256	10500	9.34
801	Scouring powder	12263	9030	4.98
801	Candles	2099	16500	22.08
801	Shoe and leather maintenance product	2958	44977	13.32
801	Floor and furniture polisher	4254	60706	10.71
801	Animal oils and fats	7237	311	9.80
801	Tallow	1575	357	4.88
801	Fish oil	3392	1780	6.88
801	Oil fat	23543	5389	30.60
801	Hide glue and bone glue	2556	31619	12.66

Indus. ID	Product Name	Value United Kingdom (£000)	Value West Germany (DM000)	UVR (DM/£)
801	Oleine	2104	5389	12.19
801	Stearine	2658	6605	14.15
801	Vegetable adhesives	2923	28400	14.91
801	Oxygen	4388	47744	16.75
801	Carbon	3266	9846	6.23
801	Phosphorus	325	54737	5.04
801	Acetylene	2885	37291	7.80
801	Inorganic and organic pigments	8925	921142	10.36
901	Bottles for drinks	10706	118338	18.79
901	Flat glass	1150	137360	2.73
902	Cement and cement binder	43975	616130	11.55
902	Limestone or dolomite	14531	241219	28.36
903	Porcelain - for industrial purposes	24	9600	16.93
903	Electrical ware of porcelain, earthenware and stoneware	4718	90244	15.18
1001	Chairs	833	115179	8.55
1001	Kitchen tables	201	14044	19.07
1001	Wardrobes	13629	48715	10.30
1001	Kitchen cabinets	2477	98287	26.88
1001	Bureaux furniture	2404	98786	8.67
1002	Sawn hardwood	18743	203444	9.97
1101	Wallpaper from paper	8688	56677	8.85
1101	Paper sacks	15176	287553	13.22
1101	Paper backs	24271	144520	11.43
1101	Corrugated fibreboard packing	3102	63460	19.03
1201	Brake and clutch linings	8045	20204	8.95
1201	Outer covers - pedal cycle	4622	62069	17.87
1201	Inner tubes - pedal cycle	1688	18721	13.48
1201	Outer tube motor cycle	2078	28736	15.87
1201	Inner tube motor cycle	347	4846	14.03
1201	Outer tube car	28257	217319	17.25
1201	Inner tube car	3353	23614	14.14
1201	Outer tube tractor and dumper	8818	188209	17.75
1201	Inner tube tractor and dumper	1007	15929	16.74
1201	Outer tubes - giant tyres (trucks)	55671	232431	31.23
1201	Inner tubes - giant tyres (trucks)	3523	13503	25.57

Indus. ID	Product Name	Value United Kingdom (£000)	Value West Germany (DM000)	UVR (DM/£)
1201	Outer covers new for barrow, trolley and other tyres	1656	18176	27.44
1201	Inner tubes - for barrow, trolley and other tyres	266	1754	16.94
1201	Mats, matting, flooring and tilling of rubber	2318	14570	11.92
1201	Rubber threats	1618	76816	6.11
1201	Rubber valves, washers and rings for industrial purposes	1978	85480	5.75
1201	Rubber sheeting (with a textile backing)	116	21932	20.08
1201	Conveyor belt	18535	70958	16.21
1201	Fan belts, V-belts	4263	39291	9.19
1202	Piano	1829	7188	18.14
1202	Plastic buttons	1320	19748	10.60
1202	Electrical insulating material of synthetic resins	1132	2597	11.29
1202	Plastic materials for preparation and serving of food and drink	244	4036	11.51

Source: own calculations see Table A-2.3 for the underlying sources.

Table A-1.5: Coverage ratios and purchasing power parities by industry, United Kingdom and West Germany, 1951

Indus. ID	Industry Name	# UVRs	Coverage Ratio		Purchasing Power Parities (DM/£)	
			United Kingdom	West Germany	Fisher based on gross output	Fisher based on value added
1	Total Industry	186	0.26	0.33	11.88	12.16
1.1	Total Manufacturing	185	0.24	0.32	11.92	11.31
100	Mining	1	0.9	0.51	16.65	16.65
200	Textiles	12	0.4	0.53	9.96	9.96
300	Leather	4	0.59	0.32	7.48	7.48
400	Clothing and Footwear	26	0.72	0.71	14.85	14.91
500	Metallurgy	17	0.27	0.39	12.01	11.2
600	Engineering and Vehicles	44	0.11	0.19	10.66	11.09
700	Food, Drink and Tobacco	21	0.18	0.3	12.6	12.53
800	Chemicals	22	0.18	0.2	10.99	10.99
900	Clay and Building Materials	6	0.2	0.28	13.13	13.18
1000	Timber and Woodworking	6	0.11	0.14	10.18	10.22
1100	Paper trades	4	0.06	0.09	12.24	12.24
1200	Miscellaneous	23	0.27	0.51	17.32	17.3
101	Coal Mining	1	0.9	0.51	16.65	16.65
201	Textiles	12	0.4	0.53	9.96	9.96
301	Leather	4	0.59	0.32	7.48	7.48
401	Footwear	4	0.88	0.99	15.67	15.67
402	Clothing	22	0.67	0.59	14.54	14.54
501	Iron and Steel	6	43	57	11.71	12.15
502	Non-Ferrous Metal	7	0.44	0.6	14.43	14.43
503	Fabricated Metal Products	4	0.04	0.07	13.87	13.87
601	Vehicles	2	0.05	0.11	7.5	7.5
602	Mechanical Engineering	35	0.19	0.2	12.51	12.51
603	Electrical Engineering	4	0.09	0.27	15.99	15.99
604	Optical and Precision Engineering	3	0.1	0.22	11.98	11.98
701	Tobacco	2	0.03 [a]	0.34	14.13	14.13
702	Beverages	1	0.06	0.14	12.77	11.77
703	Food	18	0.41[b]	0.46	12.77	11.77
801	Chemicals	22	0.18	0.2	10.99	10.99

Indus. ID	Industry Name	# UVRs	Coverage Ratio		Purchasing Power Parities (DM/£)	
			United Kingdom	West Germany	Fisher based on gross output	Fisher based on value added
901	Glass	2	0.15	0.37	8.82	8.82
902	Building Materials	2	0.27	0.29	14.77	14.77
903	China and Earthenware	2	0.07	0.14	15.26	15.26
1001	Woodwork	5	0.09	0.17	11.61	11.61
1002	Timber	1	0.13	0.11	9.97	9.97
1101	Paper and Board	4	0.1	0.13	12.24	12.24
1201	Rubber and Asbestos	19	0.49	0.73	17.4	17.4
1202	Miscellaneous	4	0.02	0.05	12.8	12.8

Notes: a) The coverage for tobacco in Britain seems to be very low, this is the result of the fact that two types of cigarettes are included in the British production statistics, cigarettes sold duty free, and cigarettes sold including duties. In the German data only duty-free cigarettes are presented. Thus, to get a correct price estimate for the British products, I could only include the products that were sold without duties. Therefore, I calculate the unit value based on duty-free cigarettes. However, this represents only a small part of British output. Thus the three per cent does not mean I only cover three per cent of the production, but the product ‘duty-free cigarettes’ I took is three per cent of production. If I assume the value of all cigarettes is the same, whether it is these ‘without duty’ and ‘with duty’ I cover around 90 per cent of British tobacco. The total amount of duties in the tobacco industry was up to 58 per cent, (rates applicable to unstrapped leaf tobacco containing no less than ten per cent of moisture, Alford (1973), Table XV, p. 438). With the information on total amounts of duties paid in the summary tables in the census I could adjust value added for duties. However, I do not have enough information about the cigarettes and their weight and quality as presented in the census. Therefore, I rely on the duty free sold cigarettes in the calculating process.

b) The coverage for food products is lower for Britain than for West Germany. Part of the reason is that the coverage ratio for margarine is very low in my estimation, which might be suprising since this industry only contains a few products. Margarine, compound lard and compound cooking fats for home consumption were produced by the margarine industry for the Ministry of Food in 1948, 1949, 1950 and 1951. Output of the industry appeared in gross output as amounts charged for work done and not as selling value, the corresponding materials supplied by the Ministry of Food were also not included in the total of materials purchase and used. I controlled for this. In Table 8 (Sales of the Principal Product) of the British Production census (Board of Trade 1954) margarine is split up in margarine for domestic and trade use. The price for the domestic use is not a market price, and hence I could only rely on the sales price of the products for trade use, since these are market prices. In the coverage ratio I take the sales value as a percentage of gross output, and hence the coverage appears much lower than in West Germany.

Source: own calculations, see Table A-1.3 for the underlying sources.

Table A-1.6: Comparative labour-productivity in manufacturing in the UK and West Germany 1951, (UK = 100)

	Per worker		Per hour	
	Gross output	Value added	Gross output	Value added
Textiles	90	114	83	105
Leather	75	103	66	91
Clothing and Footwear	96	100	85	89
Metallurgy (incl. Non-Ferrous)	78	97	70	86
Engineering and Vehicles	93	87	83	77
food, Drink and Tobacco	91	89	75	73
Chemicals	98	120	85	104
Clay and Building Materials	78	92	68	81
Lumber and Woodworking	99	123	81	100
Paper and Printing	105	131	91	113
Miscellaneous	50	77	44	69
Total Manufacturing	84	94	75	83
Coal Mining	82	81	89	88
Total Industry	84	93	75	84

Sources: see Table 2.1 for underlying sources.

Table A-1.7: Detailed information on data sources and adjustments to data for 1935 benchmark

Description of censuses 1935
The British census covered Great Britain and Northern Ireland. Industry was classified into 123 different sub-industries. The classification was chosen to match as closely as possible to the classification system of other Government Departments involved in the compilation of statistics. Proprietors employing ten or more employees were required to report detailed returns. However, small firms were required to provide information on the annual average number of male and female workers and the nature of their business. Gross output is defined as the net selling value of all goods manufactured in the year (both sold and unsold goods). Net selling value was defined as the actual amount charged to customers, after deduction of discounts and payment to transport companies. Thus, the goods were valued when they passed out the hands of employees of the firm. Net output, which represents value added, is obtained after deducting the aggregate costs of materials and fuel used and the amount for work given out from gross output. Establishments reported refer to a single factory or workshop or other place of business were '*some process involving transformation of materials was carried on. Offices, warehouses, packing establishments, motor garages and such like ancillary places of business situated apart from the processing works were note regarded as separate establishments, but the persons employed therein and the value of their services were included in the returns for the work.*' (Board of Trade, Final Report on the Fifth Census of Production and the Import Duties Act Inquiry, p. a 4) The German census data comprises the German Empire within the borders of 1937, thus Saarland is included but Austria and Sudetenland are excluded. The census covers all production units with five employees or more. In industries where material inputs were considered to be important, information for all establishments was presented. This was for example the case in mining, fuel, iron and steel and chemicals. For other industries, such as bakeries and printing offices, the cut-off point for reporting was not five but ten employees.
Data adjustments
In some industries there were some difficulties in the matching of products, since the data set of Jaap Sleifer on West Germany provided information on a different level of aggregation than was presented for the whole of Germany. This problem manifested itself especially in the weaving mill industry, where I have only information on the aggregate sector for West Germany. At the more disaggregate level, the Sleifer data set presents gross output for the whole of Germany. Since part of the industries belonging to weaving mills working with cotton, and part of them with other materials such as jute etc., I need to attribute these parts to the cotton and jute sector respectively. To make a fair division of gross output and value added for West and East Germany, I assume that the weaving mills will have the same division of gross output over the two parts of the country as the cotton and jute sector, for which I do have this information. I assume that the division of employment between East and West Germany in the sectors belonging to weaving mills will be the same as the division in employment in the industries to which these sectors belong. Thus, I take the employment division of cotton for the cotton weaving mills, and the employment division of the wool industry for the wool weaving mills. That is, I assume that the production of cotton and jute goods is locally concentrated. Additionally I have to assume that the input-output ratio of the sub-industries of the sector are identical to the input-output coefficient of the total industry.

Description of censuses 1935
Excises and duties
I adjusted the data for excises and duties. In the British case I adjusted silk, drugs, matches, printing, aerated waters, tobacco, sugar and beer. The duties are mentioned in the General Report of the census. In West Germany the sources included taxes for margarine and edible oils.

Sources: Board of Trade (38-1944), '*Final Report on the Fifth Census of Production and the Import Duties Act Inquiry 1935*'; Fremdling et al.(2007b); Sleifer database (2003).

Table A-1.8: The classification of industries into major industry groups and industry branches (1935)

Code		Code	Included industries United Kingdom	Included industries West Germany
100	Mining	100	Coke and By-products	Kokereien
200	Textiles [1]	201	Textiles	
			201.1 Cotton Spinning and Doubling 201.2 Cotton Weaving 201.3 Woollen and Worsted 201.4 Silk and Artificial Silk 201.5 Jute 201.6 Hosiery	201.1 Baumwollspinnerei und -zwirnerei 201.2 Baumwollweberei 201.3 Wollwäscherei; Wollwäscherei und Wollkämmerei; Kammgarn- und Ramiespinnerei und –Zwirnerei; Reissgereien; Streichgarnspinnerei und -zwirnerei Weberei Wollner u. wollhalt. Oberbekleidungsgewebe; Sonstige Wollweberei 201.4 Seidenweberei; Kunstseiden- und Zellwollindustrie 201.5 Jutespinnerei und –Zwirnerei; Jutteweberei 201.6 Tricotagestickerei; Strumpfwirkerei; Strumpfstrickerei
300	Leather[2]	301	Leather	
			301.1 Leather (tanning and dressing) 301.2 Leather Goods	301.1 Lederfabriken und Gerbereien 301.2 Lederzurichtereien; Ledertreibriemenindustrie (einschl. Herstellung technischer Lederartikel); Leder- und Sattlerwarenindustrie; Lederhandschuhindustrie
400	Clothing and Footwear	401	Footwear	
			401.1 Boot and Shoe Trade	401.1 Schuhindustrie
		402	Clothing	
			402.1 clothing: Tailoring, Dressmaking, Millinery, etc.; Hat and Cap Trade; Glove Trade; Fur; Umbrella and Walking Stick	402.1 Bekleidungsindustrie; Pelzveredelung; Pelzverarbeitung

Continuation of Table A-1.8

Code		Code	Included industries United Kingdom	Included industries West Germany
500	Metallurgy[3]	501	Iron and Steel	
			501.1 Iron and Steel (Blast Furnaces) 501.2 Iron and Steel (Smelting, Refining and Rolling) 501.3 Iron and Steel Foundries incl. Hardware, Wrought Iron etc.: Iron and Steel Foundries; Hardware, Hollow-ware, Metallic Furniture and Sheet Metal; Wrought Iron and Steel Tube 501.4 Tinplate 501.5 Chain, Nail, Screw and Miscellaneous Forgings 501.6 Wire 501.7 Tool and Implement	501.1 Hochofenwerke 501.2 Flussstahlwerke (einschl.der damit verbundenen Stahlformgießereien); Schweißstahlwerke; Warmwalzwerke (einschl. Der damit verbundenen Hammer und Presswerke); 501.3 Eisen-, Temper-, und Stahlgießereien; Metallgießereien; Herd- und Ofenindustrie 501.4 Blechwarenindustrie 501.5 Sonstige Zweigen der Eisen- und Stahlwarenindustrie 501.6 Drahtwarenindustrie 501.7 Werkzeugindustrie
		502	Non-Ferrous Metals	
			502.1 Non-Ferrous Metals: Aluminium, Lead, Tin, etc. (Smelting, Rolling, etc.); Gold and Silver Refining; Finished Brass; Plate and Jewellery); Copper and Brass (Smelting, Rolling etc.)	502.1: Kupfer-, Blei- und Silberhütten; Kupferraffinerien und – Elektrolysen; Gold und Silberscheideanstalten; Zinkhütten; Zinkhütten und Entzinnungsanstalten; Tonerfabriken; Aluminiumhütten; Gewinnung von Nickel und Kobalt; Gewinnung von Wolfram, Molybdän u. anderen Metallbau; Herstellung von Ferrolegierungen, Elektrokorund, Karborund; Walz-,Press-und Hammerwerke der Nichteisenmetallindustrie; Herstellung von Warmpressteilen der Nichteisenmetallindustrie; Metallschmelzereien; Edelmetall- und Schmuckwarenindustrie

Continuation of Table A-1.8

Code		Code	Included industries United Kingdom	Included industries West Germany
		504	Fabricated Metal Products	
			504.1 Cutlery	504.1 Feine Schneidewarenindustrie (einschl. Schläge Industrie)
600	Engineering and Vehicles	601	Motor Vehicles	
			601.1 Motor and Cycle	601.1 Kraftfahrzeugindustrie; Herstellung von Kraftfahrzeuganhängern und Kraftfahrzeugaufbauten; Fahrradindustrie und Herstellung von Kinderwagen; Fahrzeugteileindustrie
		602	Machine Tools	
			602.1 Mechanical Engineering	602.1 Werkzeugmaschinenindustrie; Textilmaschinenindustrie; Herstellung von Maschinen für das Bekleidungsgewerbe; Landmaschinenindustrie; Herstellung von Maschinen und Apparaten für die Papierherstellung, Papierverarbeitung und für das graphische Gewerbe; Büromaschinenindustrie; Herstellung von Maschinen und Apparaten für Müllerei, Nahrungsmittel- und Genussmittelindustrie u.ä.; Armaturenindustrie; Sonstiger Maschinenbau; Kessel-und Apparatebau; Stahlbau
		603	Electrical Engineering	
			603.1 Electrical Engineering	603.1 Herstellung von elektrischen Maschinen Apparaten und Zubehör der Stark- und Schwachstromindustrie; Kabelindustrie; Elektrokohleindustrie; Batterie- und Elementen Industrie; Akkumulatoren Industrie; Glühlampen- und Leuchtröhrenindustrie;
		604	Shipbuilding	
			Shipbuilding	604.1 Schiffbau

Continuation of Table A-1.8

Code		Code	Included industries United Kingdom	Included industries West Germany
		605	Optical and Precision Engineering	
			604.1 Scientific Instruments, Appliances and Apparatus; Watch and clock	604.1: Optische, fein- und medizinmechanische Industrie; Herstellung von orthopädischen Erzeugnissen und hygienischen Bandagen; großuhrenindustrie; Taschen- und Armbanduhrenindustrie; Photographische Industrie
		606	Railways	
			606.1 Railway Carriage and Wagon Building; Carriage Cart and Wagon	606.1 Waggonbau; Feld- und Werkbahnwagenbau
		607	Aircraft	
			607.1 Aircraft	607.1 Flugmotorenbau; Flugzeugzellenbau
700	Food, Drink and Tobacco[4]	701	Tobacco	
			701.1 Tobacco	701.1 Tabakindustrie
		702[4]	Food	
			702.1 Grain Milling 702.2 Bread Cakes, etc., 702.3 Biscuit and cocoa: Biscuit; Cocoa and Sugar Confectionary 702.4 Preserved Foods and bacon: Preserved Foods; Bacon Curing and Sausage 702.5 Butter, Cheese, Condensed Milk and Margarine 702.6 Sugar and Glucose 702.7 Cattle Dog and Poultry Foods	702.1 Getreidemüllerei; Schälmühlen 702.2 Brod Industrie und Bäckereien 702.3 Süßwaren Industrie; Teigwarenindustrie &02.4 Fleischwarenindustrie; Obst- und Gemüsekonservenindustrie; Herstellung von Rheinischkraut; Obstsaft- und Fruchtweinindustrie; Senfindustrie; Gewürzindustrie; Kartoffeltrocknerei; Nährmittelindustrie; Kaffee-Ersatz-Industrie 702.5 Dauermilchindustrie; Schmelzkäseindustrie; Margarine- und Speisefettfabriken 702.6 Zuckerindustrie 702.7 Futtermittelindustrie

Continuation of Table A-1.8

Code		Code	Included industries United Kingdom	Included industries West Germany
		703[5]	Beverages	
			703.1 Brewing and Malting	703.1 Malzindustrie; Brauindustrie (einschl. Braumälzerei)
800	Chemicals[6]	801	Chemicals	
			801.1 Chemicals, Dyestuffs and Drugs 801.2 Fertiliser, Disinfectant, Glue, etc. 801.3 Soap, Candle and Perfumery 801.4 Paint, Colour and Varnish 801.5 Seed Crushing 801.6 Petroleum 801.7 Starch and Polishes 801.8 Explosives 801.9 Matches	801.1 Schwefelsäureindustrie; Sulfat und Salzsäureindustrien; Sodaindustrien; Alkalielektoolyse Industrien; Herstellung von Wasserstoffsuperoxyd, Natriumperborat, u.a. Perverbindungen; Herstellung von Schwefel, Schwefelkohlenstoff u. Rhodanverbindungen; Herstellung von Cyan- u. Eisencyanverbindungen; Wasserglas und Bleicherde Industrie; Herstellung von Metallsalzen u.a. Chemikalien; Industrien des Phosphors; Thomasschlackenmühlen; Holzverkohlungsindustrien; Herstellung von Essigsäuren aus Acetylen; Lösungsmittelindustrie; Industrie der organischen Säuren und ihrer Salze; Industrie der Organ. Zwischenprodukte; Teerfarbenindustrie; Herstellung von Gerb- und Farbstoffextrakten; Herstellung von Nitrozellulose und davon abgeleiteten Produkten; Herstellung von Äcetylzellulose, Viskosefolien, u.a. Zelluloseprodukten; Lithopone, Blancfix und Titanweiß Industrie; Herstellung von Blei weis, Bleiglätte und Bleimennige; Herstellung von Zinkweiß; Erdfarbenindustrie; Ruß und Schwärz Industrie; Herstellung von verdichteten Gasen; Aktivkohleindustrie 801.2 Herstellung von Klebstoffen; Stickstoffindustrien; Karbid und Kalkstickstoff Industrien; Knochenverwertungsindustrie; Herstellung von Haut- und Lederleim, Gelatine und Kunstdärmen 801.3 Wachsveredlungsindustrie; Herstellung von Kerzen und Wachserzeugnissen; Stearin-industrie; Seifen-, Waschmittel- und Glyzerinindustrie; Kosmetische Industrie

Continuation of Table A-1.8

Code		Code	Included industries United Kingdom	Included industries West Germany
800	Chemicals[6]	801	Chemicals	
				801.4 Buntfarbenindustrie; Herstellung von Naturharzprodukten; Lack und Anstrichmittelindustrie; Herstellung von Druckfarben und Druckwalzenmassen; Farbwarenindustrie 801.5 Ölmühlen; Ölveredelungsindustrie 801.6 Gewinnung von Benzin u. anderen Mineralölderivaten; Herstellung von mineralische Schmierölen und fetten; Herstellung von technische Öln und Fetten 801.7 Stärke- und Stärkeveredelungsindustrie 801.8 Sprengstoffindustrie; Herstellung von Zündstoffen und Sprengkapseln; Pyrotechnische und Zündwarenindustrie 801.9 Zündholzindustrie
900	Building Materials[7]	901	Glas	
			901.1 Glass	901.1 Glashüttenindustrie; Hohlglas veredelnde und Glas verarbeitende Industrie; Flachglas veredelnde Industrie
		902	Building Materials	
			902.1 Brick and Fireclay 902.2 Cement 902.3 Other Building Materials: Building Materials	902.1 Ziegelindustrie; Kalksandsteinindustrie; Industrie feuer- und säurefester Erzeugnisse 902.2 Zementindustrie
		903	China and Earthenware	
			903.1 China and Earthenware	903.1 Steinzeug Industrie; Feinkeramische Industrie

Continuation of Table A-1.8

	Code	Included industries United Kingdom	Included industries West Germany
Lumber and Woodworking[8]	1001	1001.1 Timber and Crate: Saw-mill Products; Wooden Crates, Cases, Boxes and Trunks Trade	1001.1 Sperrholzindustrie; Sägewerke (einschl. Schwellen- und Masten Fabriken); Hobelwerke; Furnierwerke; Holzimprägnieranstalten; Sperrholzindustrie; Kistenindustrie
Paper and Printing[9]	1101	Paper	
		1101.1 Paper 1101.2 Wall Paper 1101.3 Manufactured Stationery 1101.4 Pens and Pencils	1101.1 Holzschleifereien; Zellstoffindustrie; Papier- und Pappenfabriken 1101.2 Tapetenindustrie 1101.3 Papierveredelungsindustrie; Papierwarenindustrie 1101.4 Füllfederhalterindustrie; Bleistiftindustrie
Miscellaneous[10]	1201	Rubber and Asbestos	
		1201.1 Asbestos Goods and Engine Boiler Packing 1201.2 Rubber	1201.1 Asbestindustrie 1201.2 Herstellung von Kautschukwaren (ausgenommen Bereifungen und Gummischuhe); Bereifungsindustrie; Gummischuhindustrie; Herstellung von Kautschuk-Regeneraten, -Plastikaten und –Präparaten; Herstellung von Guttapercha- und Balatawaren
		Miscellaneous	
		1301.1 Plastic Materials, Buttons and Fancy Articles 1301.2 Musical Instruments	1301.1 Herstellung von Waren aller Art aus chemischen Kunststoffen sowie aus natürlichen Schnitz- und Formerstoffen; 1301.2 Musical Instruments: _Kleinmusikinstrumentenindustrie; Herstellung von Saiten aller Art; Herstellung von Sprechmaschinen; Klavier-, Harmonium- und Orgelbau

Continuation of Table A-1.8

1. The main industry Textiles (200) for Britain also includes: Elastic Webbing; Coir Fibre, Horse-Hair and Feather; Linen and Hemp; Textile Finishing; Lace; Rope, Twine and Net; Canvas Goods and Sack; Flock and Rag; Packing. For West Germany this industry also includes: Flachs- und Hanfrösterei; Flachsspinnerei und –Zwirnerei; Hanf- und Hartfaserspinnerei und –Zwirnerei; Bekleidungsstoffweberei; Nähfäden-, Stopf-, Stick- und Handarbeitsgarnherstellung; Herstellung von Band- und Flechtartikeln, Posamenten usw.; Herstellung von Stickereien, Spitzen usw.; Herstellung von Zelften, Planen, Säcken; Filzherstellung; Industriewatteherstellung; Verbandwatteherstellung; Herstellung von Verbandmitteln; Rosshaarspinnerei und Stepperei; Netzindustrie; Textilausrüstungs- und Veredelungsindustrie
2. The main industry Leather (300) for Britain also includes: Fellmongery.
3. The main industry Iron and Steel (500) for Britain also includes: Needle, Pin and Metal Small Wares; Small Arms.
4. The main industry group Food (702) for Britain also includes: Bread, Cakes, Pastries etc.; Fish Curing; Ice. For West Germany this industry also includes: Landwirtschaftliche Kartoffelbrennereien; Melassebrennereien; Hefelüftungsbrennereien; Spiritusreinigungsanstalten u. Spiritusvergällung in Monopollägern; Kornbrennereien; Weinbrennereien; Herstellung von Trinkbranntweinen aller Art; Fischindustrie; Traubenschaumweinindustrie; Essigindustrie
5. The main industry group Beverages (703) for Britain also includes: Spirit Distilling; Spirit Rectifying, Compounding and Methylating; Aerated Waters, Cider, Vinegar and British Wine; Wholesale bottling.
6. The main industry group Chemicals (800) for Britain also includes: Oil and Tallow; Manufactured Fuel. For West Germany this industry also includes: Herstellung von metallische Überzügen; Industrie der Kunststoffen; Herstellung von Hilfsmitteln für die Textil- und Lederindustrie; Herstellung von Atemschütz und Frischluftguterärt; Talgschmelzen; Schmalzsiedereien; Abdeckereien; Fischmehl- und Tranfabriken
7. The main industry group Building Materials (900) for West Germany also includes: Steinbruchindustrie und Natursteinbearbeitung; Schieferindustrie; Gewinnung von Findlingsguarziten und sonstigen Quarzitgestein; Gewinnung und Aufbereitung von Naturasphaltgestein; Mineralmühlen-und Aufbereitungsbetriebe; Baukies und Bausandgruben und baggereien; Glassand, Formsand, Klebsand, und sonstige Quarzsandgruben; Kieselgurgruben; Gewinnung und bearbeitung von Torf; Gewinnung und Aufbereitung von Kreide; Farberdegruben; Kieselkreidegruben; Schwerspatgruben; Speckstein und Talkumgruben; Feldspatgruben und –werke; Rohton und Bleicherdegruben; Kaolingruben (einschl. Aufbereitungsanlagen); Kalkindustrie; Magnesitgruben und –werke; Gipsindustrie; Mörtelwerke; Edelputzwerke; Bimsbaustoffindustrie; Schlackenindustrie; Betonwaren und Betonwerksteinindustrie; Asbestzementindustrie; Leichtbauplattenindustrie; Steinholzindustrie; Herstellung von Korkstein- u. Kieselgurwaren und sonstigen Erzeugnissen für Temperatur und Schalschutz; Schleifmittelindustrie
8. The main industry group Lumber and Woodworking (1000) for Britain also includes: Furniture and Upholstery; Cane and Wicker Furniture and Basketware Trade; Coopering Trade. For West Germany this industry also includes: Möbel- und Bauteileindustrie; Holzwarenindustrie; Holzmehlindustrie; Fassholzsägerei und Fassindustrie; Holzwolleindustrie; Stuhlrohrfabriken; Korbwaren- und Korbmöbelindustrie; Herstellung von Schilrohr- und Strohgeweben, Flaschenhülsen und Trinkhalmen; Korkindustrie; Borsten- Faserstoff- und Haarzurichtereien; Bürsten- und Pinselindustrie
9. The industry Paper and Printing (1100) for Britain also includes: Cardboard Box; Printing, Bookbinding, Stereotyping, Engraving, etc.; Printing and Publication of Newspapers and Periodicals. For West Germany this industry includes also: Druckgewerbe; Chemigraphisches Gewerbe; Buchbindereien; Pappen verarbeitende Industrie.
10. The main industry group Miscellaneous Trades (1200) for Britain also includes: Linoleum and Oilcloth; Brush; Games and Toys; Sports Requisites; Manufactured Abrasives

Sources: see Table A-2.7 for the underlying sources.

Table A-1.9: The construction of industry Fisher PPPs for British and West-German industry in 1935

			Coverage ratio		Purchasing Power Parities (DM/£)	
	Industry	No. of UVRs	United Kingdom	West Germany	Fisher based on gross output	Fisher based on value added based
1	Manufacturing	229	0.42	0.43	17.80	18.20
100	Textiles	12	0.51	0.43	20.93	21.18
200	Leather	6	0.36	0.35	25.45	25.85
300	Clothing and footwear	5	0.28	0.38	21.92	21.94
400	Metallurgy	45	0.47	0.45	14.91	15.09
500	Engineering and Vehicles	45	0.30	0.27	17.16	17.25
600	Food Drink and Tobacco	23	0.62	0.68	23.46	24.21
700	Chemicals	57	0.41	0.52	16.50	16.76
800	Building Materials	13	0.43	0.38	15.54	15.57
900	Lumber and Woodworking	3	0.16	0.26	10.21	10.21
1000	Paper and Printing	10	0.21	0.20	14.42	14.45
1100	Miscellaneous industries	7	0.16	0.13	18.66	18.62
1200	Coal	3	0.08	0.98	19.32	19.32
101	Cotton Spinning and Doubling	1	0.72	0.70	20.17	20.17
102	Cotton Weaving	1	0.77	0.67	25.40	25.40
103	Woollen and Worsted	3	0.58	0.71	22.70	22.70
104	Silk and Artificial Silk	1	0.41	0.36	15.64	15.64
105	Jute	3	0.48	0.62	20.05	20.05
106	Hosiery	3	0.55	0.63	18.69	18.69
201	Leather (tanning and dressing)	5	0.37	0.48	29.12	29.12
202	Leather Goods	1	0.49	0.10	18.56	18.56
301	Clothing	4	0.09	0.19	21.02	21.02
302	Footwear	1	0.90	0.84	24.04	24.04
401	Iron and Steel (Blast Furnaces)	3	0.91	0.93	18.67	18.67
402	Iron and Steel (Smelting, refining and Rolling)	4	0.30	0.59	14.69	14.69
403	Iron and Steel Foundries incl. Hardware, Wrought Iron etc.	5	0.45	0.44	14.02	14.02
404	Tinplate	2	0.63	0.38	16.87	16.87

	Industry	No. of UVRs	Coverage ratio United Kingdom	West Germany	Purchasing Power Parities (DM/£) Fisher based on gross output	Fisher based on value added based
405	Chain, Nail, Screw and Miscellaneous Forgings	7	0.21	0.22	15.38	15.38
406	Wire	4	0.27	0.26	15.47	15.47
407	Tool and Implement	2	0.20	0.19	14.97	14.97
408	Cutlery	3	0.56	0.75	15.29	15.29
409	Non Ferrous Metals	15	0.67	0.46	15.40	15.40
501	Motor Vehicles	7	0.54	0.55	18.48	18.48
502	Mechanical Engineering	24	0.18	0.25	17.47	17.47
503	Electrical Engineering	8	0.22	0.19	13.99	13.99
504	Shipbuilding	2	0.36	0.31	17.19	17.19
505	Aircraft	1	0.14	0.03	17.70	17.70
506	Railways	3	0.16	0.44	20.84	20.84
601	Tobacco	2	1.01	0.85	32.20	32.20
602	Grain Milling	1	0.74	0.92	29.59	29.59
603	Bread, Cakes, etc.	1	0.87	1.00	21.46	21.46
604	Biscuit and Cocoa	5	0.85	0.75	21.87	21.87
605	Preserved Foods and Bacon	7	0.41	0.47	19.15	19.15
606	Butter, Cheese, Condensed Milk and Margarine	1	0.22	0.79	26.00	26.00
607	Sugar and Glucose	2	0.76	0.91	31.99	31.99
608	Cattle. Dog and Poultry Foods	2	0.63	0.68	25.50	25.50
609	Brewing and Malting	2	0.89	0.66	18.71	18.71
701	Chemicals, Dyestuffs and Drugs	32	0.45	0.26	17.22	17.22
702	Fertiliser, Disinfectant, Glue, etc.	6	0.43	0.37	15.76	15.76
703	Soap, Candle and Perfumery	5	0.54	0.46	17.00	17.00
704	Paint, Colour and Varnish	6	0.35	0.43	13.36	13.36
705	Seed Crushing	3	0.58	0.47	18.11	18.11
706	Petroleum	2	0.71	0.41	25.40	25.40
707	Starch and Polishes	1	0.10	0.47	10.47	10.47
708	Explosives	1	0.32	0.09	15.08	15.08
709	Matches	1	0.97	0.99	8.96	8.96

	Industry	No. of UVRs	Coverage ratio: United Kingdom	Coverage ratio: West Germany	Purchasing Power Parities (DM/£): Fisher based on gross output	Purchasing Power Parities (DM/£): Fisher based on value added based
801	Brick and Fireclay	4	0.66	0.69	14.84	14.84
802	China and Earthenware	4	0.22	0.54	15.86	15.86
803	Glass	4	0.35	0.24	17.59	17.59
804	Cement	1	0.91	0.96	14.80	14.80
901	Timber and crates	3	0.35	0.54	10.21	10.21
1001	Paper	5	0.75	0.40	14.40	14.40
1002	Wall Paper	1	1.00	1.00	12.01	12.01
1003	Manufactured Stationery	3	0.25	0.22	15.08	15.08
1004	Pens and Pencils	1	0.16	0.53	13.81	13.81
1101	Asbestos	2	0.19	0.08	17.11	17.11
1102	Rubber	3	0.43	0.18	18.75	18.75
1103	Plastic Materials, Buttons and Fancy Articles	1	0.12	0.17	15.08	15.08
1104	Musical Instruments	1	0.29	0.10	24.66	24.66
1201	Coke and By-Products	3	0.08	0.98	19.32	19.32

Note: the coverage ratio applies to West Germany as a whole (East and West).

Source: own calculations, see Table A-2.7 for the underlying sources.

Table A-1.10: Hours worked per industry in 1935 Britain and Germany

Ind. id	Industry	Annual hours Germany	Annual hours United Kingdom
1	Total manufacturing	2133.57	2255.00
100	Coal mining	2051.15	2037.00
200	Textiles	1981.38	2250.01
300	Leather	2075.04	2301.90
400	Clothing	2058.65	2141.52
500	Metallurgy	2225.83	2274.68
600	Engineering, Shipbuilding and Vehicles[1]	2228.40	2265.61
700	Non-Ferrous Metals	2232.85	2273.59
800	Food, Drink and Tobacco	2108.75	2287.75
900	Chemicals	2159.33	2257.76
1000	Clay and Building Materials[1]	2197.43	2264.16
1100	Paper, Printing and Stationery	2124.74	2292.46
1200	Lumber and Woodworking	2163.55	2278.31
1300	Miscellaneous[2]	2088.62	2263.00
101	Coal Mining	2051.15	2037.00
201	Textiles	1981.38	2250.01
301	Leather	2075.04	2301.90
401	Footwear	1981.38	2141.52
402	Clothing	2199.14	2141.52
501	Blast Furnaces	2225.83	2274.68
502	Iron Foundries	2225.83	2274.68
504	Fabricated Metal Products	2140.13	2274.68
601	Non-Ferrous Metals	2232.85	2274.68
701	Vehicles	2145.28	2265.61
702	Mechanical Engineering	2294.67	2265.61
703	Electrical Engineering	2160.27	2265.61
704	Optical and Precision Engineering[3]	2160.27	2265.61
801	Beverages	2108.75	2287.75
802	Tobacco	2108.75	2287.75
803	Food	2108.75	2287.75
901	Chemicals	2159.33	2257.76
1001	Glass	2211.78	2264.16
1002	Building Materials	2218.81	2264.16
1003	China and Earthenware	2073.16	2264.16
1101	Lumber and woodworking	2163.55	2278.31

1201	Paper and Board	2124.74	2292.46
1301	Rubber and Asbestos	2088.62	2263.00
1302	Miscellaneous	2088.62	2263.00

1. For engineering, shipbuilding and vehicles trade I took the weighted average (based on employment shares) of the annual hours of the sub-industries: vehicles, mechanical engineering and electrical engineering. For building materials I took the weighted average (based on employment shares) of the annual hours worked of the sub-industries: building materials, glass and china and earthenware.
2. The number of hours worked in the industry ‘miscellaneous’ is based on the number of hours worked in rubber and asbestos since this is the biggest industry within this group, and not separate hourly information is available for the miscellaneous group.
3. the hours worked for optical and precision engineering is the same as in electrical engineering, there is no separate entry for the former in the data.

British industry was operating on a six-day workweek.

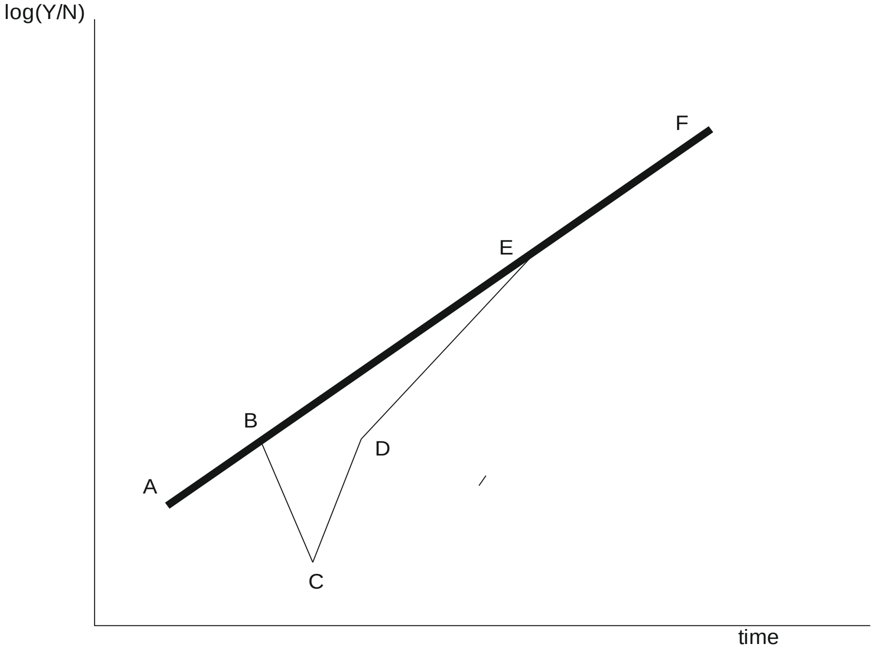
Sources: own calculations. For Britain based on International Labour Office (1939), ‘Year Book of Labour Statistics 1939’ p. 44; Department of Employment and Productivity (1971), ‘British labour statistics: historical abstract 1886-1968’, pp. 96-97, 104-107. Information on Germany is obtained from Statistisches Reichsamt (1940), ‘Statistisches Jahrbuch 1939/40’, p. 384. Data on holidays isobtained from Huberman and Minns (2007). pp. 546-5468.

Table A-1.11: Comparative labour-productivity in manufacturing, in the United Kingdom and West Germany 1935, (UK = 100)

	Per worker		Per hour	
	Gross output	Value added	Gross output	Value added
Textiles	85	109	97	124
Leather	58	84	64	93
Clothing and Footwear	88	90	93	95
Metallurgy (incl. Non-Ferrous)	129	128	132	131
Engineering and Vehicles	103	120	105	122
food, Drink and Tobacco	60	65	65	71
Chemicals	116	111	121	116
Clay and Building Materials	85	96	88	99
Lumber and Woodworking	140	151	147	159
Paper and Printing	115	100	124	108
Miscellaneous	81	96	89	105
Total Manufacturing	98	107	105	115
Coal Mining	159	119	158	119
Total Industry	101	108	109	115

Sources: see Table 2.4.

Figure A-2. 1: The Jánossy model of post-war reconstruction

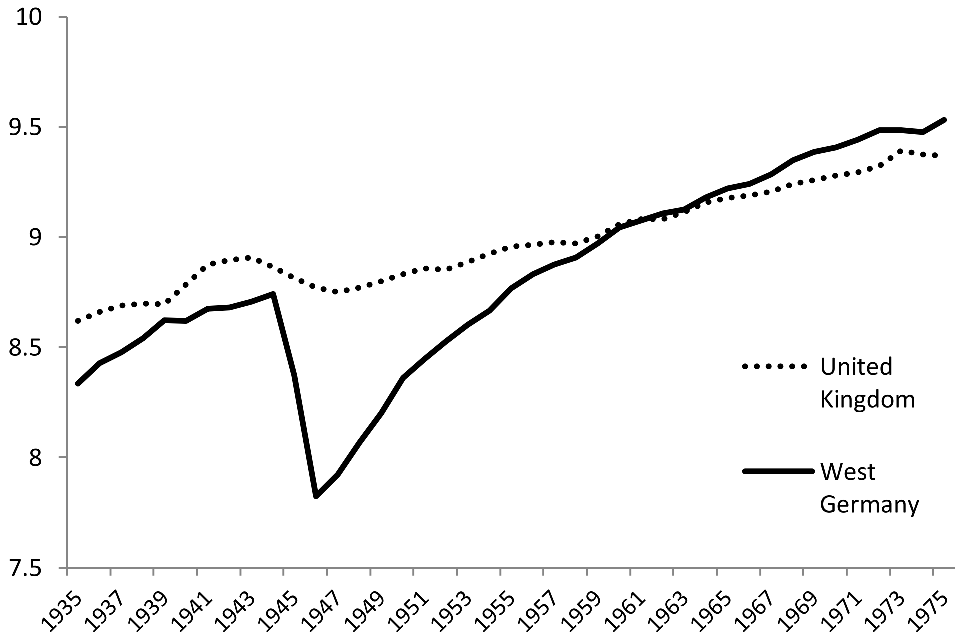


Source: Jánossy (1969), p. 10.

Note: The Hungarian Ferenc Jánossy formulated the reconstruction thesis as indicated in Figure A1 below (Jánossy 1969). The trend line of normal growth is shown by segment AF. Segment BC illustrates the war-induced drop in output and segment CD represents the very rapid growth path towards recovery of pre-war levels in point D, which can be seen as recovery or rebuilding. Segment DE represents reconstruction, with higher than normal growth rates, which continues until the economy is back on its long term normal growth path.

Figure A2 shows GDP per capita for West Germany and the United Kingdom for the period 1935 till 1975. The German line clearly shows the same pattern as the reconstruction line in Figure A1. West Germany witnessed a large decrease in GDP per capita near the end of the war, but was able to recover quickly to its pre-war level.

Figure A-2. 2 GDP per capita in the United Kingdom and West Germany (international Geary-Khamis dollars) 1935-1975



Source: Maddison (1995), Table D1a, pp. 194 - 197.

Table A-2.1: Industry information based on the size of establishments 1935

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Share in GO	Share in VA	Share in employment	Productivity (average = 100)
			Textiles				
11- 24	1185	20.7	0.28	3.01	2.37	1.96	121
25-49	1398	50.6	0.34	5.60	5.35	4.79	112
50-99	1451	104.3	0.34	11.07	10.76	9.88	109
100-199	1453	208.5	0.34	20.09	19.54	19.77	99
200-299	701	171.8	0.34	16.58	15.94	16.29	98
300-399	361	125	0.35	10.94	10.70	11.85	90
400-499	173	76.9	0.33	6.81	6.34	7.29	87
500-749	166	99.5	0.36	8.47	8.63	9.44	91
750-999	76	64.6	0.41	5.23	6.02	6.12	98
1000-1499	41	49.3	0.36	4.68	4.76	4.68	102
1500 and over	33	83.6	0.45	7.51	9.60	7.92	121
			Leather				
11-24	285	5.0	0.34	8.60	9.41	9.94	95
25-49	249	8.9	0.32	15.17	15.86	17.52	91
50-99	182	12.7	0.31	25.07	24.94	25.09	99
100-199	87	11.8	0.30	26.34	25.30	23.38	108
200-299	20	4.9	0.30	10.21	9.90	9.74	102
300-399	9	3.0	0.32	6.77	6.92	5.88	118
400 and over	9	4.3	0.30	7.83	7.67	8.46	91
			Iron and Steel				
11-24	997	17.5	0.55	2.12	2.79	3.25	86
25-49	995	34.4	0.51	4.57	5.66	6.38	89
50-99	740	52.2	0.49	7.27	8.59	9.67	89
100-199	541	75.1	0.44	12.43	13.22	13.93	95
200-299	258	63.3	0.44	10.85	11.60	11.73	99
300-399	125	43.1	0.37	8.98	8.07	8.00	101
400-499	74	32.9	0.36	6.77	5.92	6.09	97
500-749	91	55.6	0.36	11.96	10.34	10.30	100
750-999	42	35.6	0.43	6.86	7.05	6.60	107
1000-1499	38	46.8	0.38	10.09	9.25	8.68	107
1500 and over	32	82.8	0.40	18.09	17.51	15.36	114
			Engineering, Shipbuilding and Vehicles				

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Share in GO	Share in VA	Share in employment	Productivity (average = 100)
11-24	2670	44.1	0.60	2.86	3.36	4.00	84
25-49	1764	60.6	0.55	4.45	4.85	5.48	88
50-99	1056	73.8	0.54	5.75	6.09	6.68	91
100-199	745	104.9	0.53	8.62	8.93	9.50	94
200-299	291	70.7	0.54	5.89	6.28	6.40	98
300-399	170	58.8	0.52	5.18	5.29	5.30	100
400-499	97	43.6	0.50	4.08	3.99	3.95	101
500-749	152	93.8	0.50	8.41	8.37	8.50	99
750-999	86	74.3	0.53	5.99	6.29	6.73	93
1000-1499	92	112.0	0.50	10.03	9.96	10.14	98
1500 and over	108	368.1	0.48	38.74	36.59	33.33	110
Non-Ferrous Metals							
11-24	484	8.3	0.36	4.74	6.22	6.80	91
25-49	373	13.1	0.41	6.20	9.07	10.77	84
50-99	263	18.2	0.34	10.92	13.25	14.88	89
100-199	155	21.3	0.35	13.12	16.60	17.43	95
200-299	56	13.6	0.23	12.45	10.23	11.11	92
300-399	29	9.8	0.23	11.58	9.73	8.03	121
400-499	15	6.7	0.40	3.20	4.66	5.49	85
500-749	23	13.7	0.40	8.22	11.84	11.23	105
750-999	7	6.3	0.06	21.95	4.95	5.14	96
1000 and over	9	11.1	0.49	7.62	13.44	9.12	147
Food, Drink and Tobacco							
11-24	3185	52.9	0.32	6.83	7.12	10.15	70
25-49	1732	59.8	0.29	10.10	9.51	11.49	83
50-99	972	67.0	0.30	12.53	12.48	12.87	97
100-199	494	68.6	0.31	12.89	13.17	13.18	100
200-299	176	42.6	0.30	9.21	9.19	8.18	112
300-399	92	31.6	0.27	7.22	6.46	6.08	106
400-499	38	17.3	0.27	3.21	2.85	3.32	86
500-749	57	34.0	0.35	6.23	7.22	6.54	110
750-999	33	28.5	0.36	4.91	5.84	5.47	107
1000-1499	25	29.2	0.39	3.89	5.03	5.61	90
1500 and over	33	89.1	0.28	22.99	21.14	17.12	123
Chemicals							

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Share in GO	Share in VA	Share in employment	Productivity (average = 100)
11-24	614	10.7	0.41	5.51	4.99	5.53	90
25-49	481	16.6	0.42	8.16	7.45	8.54	87
50-99	348	24.1	0.40	12.47	10.92	12.43	88
100-199	233	32.3	0.43	18.09	17.20	16.66	103
200-299	56	13.6	0.48	7.67	8.02	7.01	114
300-399	40	13.9	0.41	8.49	7.66	7.16	107
400-499	22	9.8	0.50	5.07	5.55	5.06	110
500-749	29	17.3	0.44	9.75	9.43	8.93	106
750-999	12	10.4	0.52	4.97	5.69	5.38	106
1000-1499	6	7.2	0.39	3.96	3.43	3.70	93
1500 and over	12	38.0	0.56	15.87	19.67	19.60	100
Miscellaneous							
11-24	555	9.4	0.54	3.58	4.03	5.14	78
25-49	422	14.8	0.52	5.85	6.39	8.12	79
50-99	307	21.9	0.44	10.81	10.01	12.01	83
100-199	210	28.4	0.38	18.36	14.43	15.53	93
200-299	67	16.1	0.43	9.65	8.67	8.82	98
300-399	36	12.4	0.55	6.14	7.11	6.77	105
400-499	30	13.1	0.49	5.94	6.10	7.18	85
500-749	15	9.3	0.54	5.28	5.97	5.08	118
750-999	9	7.5	0.52	4.31	4.72	4.09	115
1000-1499	12	14.7	0.51	9.97	10.68	8.06	133
1500 and over	13	35.1	0.52	20.13	21.88	19.20	114
Clay and Building Materials							
11-24	861	14.9	0.54	6.93	5.91	5.96	99
25-49	939	33.1	0.62	13.68	13.25	13.25	100
50-99	567	39.8	0.62	15.80	15.48	15.96	97
100-199	369	50.7	0.62	20.72	20.21	20.33	99
200-299	107	26.2	0.67	10.59	11.10	10.52	106
300-399	57	19.6	0.67	6.56	6.94	7.84	89
400-499	31	13.7	0.68	4.90	5.27	5.47	96
500-749	35	21.6	0.63	10.19	10.11	8.67	117
750-999	9	7.4	0.66	2.14	2.22	2.97	75

Size - nr. employees	Nr. establishments	Total nr. employees (‘000s)	VA/GO	Share in GO	Share in VA	Share in employment	Productivity (average = 100)
1000-1499	7	8.5	0.69	2.52	2.72	3.39	80
1500 and over	6	14.0	0.73	5.96	6.80	5.63	121
			Timber				
11-24	1474	25.7	0.47	12.46	12.33	13.19	93
25-49	1122	38.5	0.46	20.22	19.69	19.73	100
50-99	683	46.2	0.46	24.21	23.37	23.68	99
100-199	279	38.1	0.49	19.50	19.98	19.55	102
200-299	71	17.1	0.49	8.49	8.84	8.76	101
300-399	30	10.1	0.45	4.98	4.77	5.17	92
400-499	15	6.6	0.53	3.56	4.00	3.39	118
500-749	10	6.0	0.48	3.28	3.32	3.10	107
750 and over	6	6.7	0.53	3.30	3.71	3.42	108
			Paper, Printing and Stationary				
11-24	1540	26.4	0.67	4.12	4.58	6.45	71
25-49	1281	44.9	0.65	7.63	8.18	10.97	75
50-99	765	54.2	0.62	10.57	10.89	13.25	82
100-199	453	63.4	0.58	14.09	13.55	15.49	87
200-299	199	48.6	0.57	11.76	11.00	11.88	93
300-399	81	27.8	0.58	6.31	6.07	6.79	89
400-499	41	18.1	0.53	4.64	4.06	4.42	92
500-749	66	40.6	0.59	11.38	11.00	9.93	111
750-599	23	19.8	0.58	5.88	5.62	4.84	116
1000-1499	15	18.8	0.66	6.58	7.16	4.59	156
1500 and over	19	46.6	0.64	17.04	17.89	11.40	157
			Total Manufacturing				
11-24	13850	235.6	0.42	4.67	4.69	5.10	92
25-49	10756	375.1	0.42	7.58	7.60	8.12	94
50-99	7334	514.3	0.41	10.82	10.65	11.13	96
100-199	5019	703.1	0.41	14.54	14.33	15.21	94
200-299	2002	488.5	0.40	10.25	9.94	10.57	94
300-399	1030	354.7	0.38	7.73	7.12	7.68	93
400-499	545	242.9	0.40	4.80	4.65	5.26	89
500-749	644	391.6	0.43	8.24	8.59	8.47	101
750-599	303	261.0	0.40	5.91	5.68	5.65	101

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Share in GO	Share in VA	Share in employment	Productivity (average = 100)
1000-1499	245	297.6	0.46	6.16	6.76	6.44	105
1500 and over	256	757.4	0.43	19.30	19.99	16.39	122

Source: own calculations based on Board of Trade (1938-1944), '*Final Report of the Fifth Census of Production and the Import Duties Act Inquiry 1935*'.

Table A-2.2: Industry information based on the size of establishments 1951

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO (%)	Share in VA (%)	Share in employment (%)	Productivity (average = 100)
				Treatment of Non-Ferrous Mining Products other than Coal				
11-24	734	13.2	0.47	373	4.55	4.17	4.54	92
25- 99	1395	68.4	0.50	381	22.57	22.18	23.56	94
100-299	476	80.3	0.49	379	28.38	27.43	27.67	99
300-399	68	23.6	0.48	364	8.99	8.46	8.12	104
400-499	43	18.9	0.55	356	5.59	6.03	6.50	93
500-749	46	27.9	0.54	353	9.46	9.95	9.63	103
750-999	14	12.0	0.50	389	5.12	5.06	4.14	122
1000-1499	8	9.1	0.55	371	2.74	2.94	3.14	94
1500-1999	9	45.7	0.57	400	5.37	5.95	5.42	110
2000 and over	7	21.1	0.55	392	7.24	7.81	7.27	107
				Chemicals				
11-49	1128	29.6	0.29	411	8.08	8.14	7.88	103
50-99	445	31.0	0.31	403	8.13	8.59	8.26	104
100-199	330	46.9	0.31	401	12.20	12.95	12.48	104
200-299	133	32.4	0.30	391	7.85	8.21	8.64	95
300-399	62	21.8	0.32	400	5.72	6.29	5.80	108
400-499	47	21.2	0.30	412	6.54	6.77	5.65	120
500-749	68	40.7	0.25	402	10.59	9.24	10.84	85
750-1000	29	25.2	0.31	423	6.38	6.76	6.71	101
1000-1499	28	32.9	0.30	454	10.51	10.77	8.76	123
1500-1999	7	11.9	0.24	450	4.01	3.26	3.17	103
2000-2499	8	18.0	0.40	425	3.17	4.41	4.79	92
2500 and over	14	63.8	0.25	459	16.84	14.60	17.00	86
				Metal Manufacturers				
11-49	800	22.1	0.32	416	3.58	3.88	4.11	94
50-99	382	27.0	0.29	422	4.95	4.85	5.02	97
100-299	463	78.4	0.32	427	13.61	14.30	14.59	98
300-399	89	30.9	0.25	422	7.35	6.22	5.75	108
400-499	64	28.9	0.28	434	5.65	5.26	5.38	98
500-749	104	63.2	0.30	427	11.29	11.21	11.76	95
750-999	43	36.4	0.30	446	6.55	6.51	6.77	96
1000-	46	5.2	0.29	443	10.67	10.36	10.27	101

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO (%)	Share in VA (%)	Share in employment (%)	Productivity (average = 100)
1499								
1500-1999	25	43.2	0.36	431	8.10	9.82	8.03	122
2000-2499	16	35.9	0.26	449	7.78	6.77	6.67	101
2500-2999	11	30.1	0.26	460	6.38	5.58	5.59	100
3000-3999	11	35.9	0.31	436	5.95	6.12	6.69	91
4000-4999	4	17.4	0.31	471	2.97	3.05	3.25	94
5000 and over	5	32.9	0.35	440	5.18	6.08	6.12	99
Engineering, Shipbuilding and Electrical Goods								
11-24	2081	36.7	0.55	366	1.83	2.05	2.17	95
25-49	1993	69.3	0.52	376	3.87	4.10	4.09	100
50-99	1500	105.5	0.51	379	5.97	6.23	6.22	100
50-399	3203	440.7	0.50	387	26.50	27.17	25.99	105
400-499	167	74.2	0.48	387	4.66	4.54	4.37	104
500-749	223	135.6	0.47	393	8.65	8.36	8.00	105
750-999	127	109.6	0.48	377	6.68	6.55	6.46	101
1000-1499	143	173.6	0.44	391	11.83	10.68	10.24	104
1500-1999	73	126.0	0.46	382	7.99	7.56	7.43	102
2000-2499	36	79.0	0.47	391	4.93	4.73	4.66	102
2500-2999	27	72.9	0.45	409	4.72	4.36	4.30	101
3000-3999	24	81.0	0.48	405	4.79	4.73	4.78	99
4000-4999	7	31.8	0.51	407	1.90	1.99	1.87	106
5000-7499	14	88.2	0.50	381	4.49	4.62	5.20	89
7500-9999	7	62.2	0.47	394	2.98	2.85	3.67	78
10000 and over	5	114.7	0.66	421	4.20	5.69	6.77	84
Vehicles								
100-199	355	49.5	0.47	390	4.91	5.77	6.50	89
300-399	73	25.3	0.51	406	2.54	3.18	3.32	96
total 11-399	3214	198.1	0.48	385	19.21	22.88	26.03	88

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO (%)	Share in VA (%)	Share in employment (%)	Productivity (average = 100)
400-749	119	56.0	0.42	396	8.36	8.62	8.54	101
750-1499	88	94.4	0.42	421	12.49	13.01	12.40	105
1500-2499	52	102.4	0.45	409	11.50	12.83	13.46	95
2500-3999	29	89.8	0.37	433	11.66	10.75	11.80	91
4000 and over	30	211.3	0.35	457	36.77	31.90	27.77	115
Metal Goods not elsewhere specified								
11-24	1310	23.1	0.50	343	4.57	5.13	5.64	91
25-49	1229	43.7	0.48	345	9.08	9.88	10.65	93
50-99	824	57.4	0.46	345	12.69	13.25	13.99	95
100-199	455	63.0	0.46	352	14.49	15.15	15.35	99
200-299	182	44.4	0.44	341	10.97	10.91	10.81	101
300-399	99	33.7	0.42	359	9.22	8.77	8.21	107
300-749	228	103.6	0.42	357	27.76	26.25	25.25	104
750-999	31	25.8	0.40	317	6.39	5.72	6.30	91
1000-1499	20	24.3	0.41	361	6.81	6.30	5.92	106
1500 and over	12	25.0	0.45	376	7.25	7.41	6.09	122
Scrap Metal Processing								
11-24	107	1.82.5	0.16	381	24.44	21.91	19.54	112
25-49	72	1.4	0.12	390	37.01	24.55	26.56	92
50-99	19	2.4	0.16	371	16.91	15.30	14.59	105
100-199	17	1.3	0.27	364	17.44	26.37	25.51	103
200-299	5	9.4	0.50	356	4.20	11.88	13.80	86
Precision Instruments, Jewellery etc.								
11-24	477	8.3	0.49	342	5.18	6.24	7.03	89
25-199	713	46.2	0.44	348	32.74	35.26	38.96	90
200-399	67	18.1	0.35	341	16.99	14.47	15.25	95
400-499	12	5.2	0.57	357	3.86	5.46	4.42	124
500-749	18	11.2	0.33	353	12.06	9.95	9.44	105
750-1499	19	19.3	0.38	388	19.69	18.30	16.30	112
1500 and over	4	10.2	0.44	441	9.48	10.32	8.61	120
Textiles								
11-24	1263	22.2	0.20	302	2.85	2.24	2.40	93
11-199	5611	368.3	0.23	309	43.39	38.32	39.84	96
200-299	633	154.6	0.26	311	15.96	16.06	16.73	96

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO (%)	Share in VA (%)	Share in employment (%)	Productivity (average = 100)
300-399	308	105.7	0.26	306	10.90	10.96	11.44	96
400-499	146	65.4	0.27	307	6.60	6.79	7.07	96
500-749	134	80.9	0.28	323	8.03	8.54	8.75	98
750-999	38	32.2	0.26	317	3.07	3.14	3.49	90
1000-1499	24	27.2	0.26	303	2.70	2.75	2.94	93
1500-1999	18	30.7	0.29	351	3.12	3.44	3.32	104
2000-2499	11	24.4	0.37	327	2.30	3.28	2.63	124
2500 and over	9	35.0	0.45	390	3.91	6.72	3.79	177
Leather, Leather Goods and Fur								
11-49	674	17.1	0.29	339	21.62	26.59	28.75	92
100-199	105	14.3	0.23	354	25.04	24.55	24.02	102
50-299	342	34.7	0.23	354	61.27	60.34	58.37	103
300-499	13	5.0	0.18	369	12.08	9.24	8.36	111
500-999	4	2.7	0.18	414	5.03	3.83	4.51	85
Clothing								
11-24	2560	43.6	0.44	270	6.58	8.16	8.14	100
25-49	2144	74.9	0.38	278	12.97	14.14	13.97	101
50-99	1392	96.8	0.35	268	18.03	17.92	18.07	99
100-199	738	101.8	0.34	268	19.65	19.07	18.99	100
200-499	415	123.2	0.34	268	24.52	23.43	22.98	102
500-1499	104	79.8	0.34	262	15.37	14.71	14.88	99
1500 and over	7	15.9	0.31	278	2.88	2.57	2.97	86
Food, Drink and Tobacco								
11-49	4121	107.7	0.21	310	10.99	13.30	16.68	80
50-99	1241	86.8	0.20	328	10.27	11.99	13.45	89
100-199	693	96.3	0.21	331	11.56	14.03	14.92	94
200-299	267	65.9	0.20	340	8.96	10.29	10.21	101
300-399	152	52.5	0.20	345	8.15	9.47	8.14	116
400-499	59	26.1	0.18	337	4.30	4.52	4.05	112
500-749	82	51.2	0.19	328	7.95	8.69	7.93	110
750-999	36	30.8	0.17	334	5.19	5.23	4.77	110
10000-1499	37	43.2	0.26	334	4.67	6.96	6.69	104
1500-1999	10	17.3	0.11	351	5.95	3.71	2.67	139
2000-	5	11.5	0.21	334	1.83	2.25	1.79	126

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO (%)	Share in VA (%)	Share in employment (%)	Productivity (average = 100)
2499								
2500-2999	6	16.4	0.08	411	6.99	3.36	2.55	132
3000 and over	8	38.9	0.13	333	8.23	6.01	6.02	100
unclassified	579	0.9	0.01	546	4.95	0.19	0.13	145
Manufactures of Wood and Cork								
11-24	1614	28.1	0.39	341	11.07	11.12	11.62	96
25-49	1373	47.5	0.37	352	19.66	18.75	19.63	96
50-99	786	54.4	0.37	356	22.68	21.95	22.49	98
100-399	485	82.6	0.39	374	33.46	33.97	34.16	99
400 and over	49	29.3	0.42	422	13.13	14.22	12.11	117
Paper and Printing								
11-24	1557	26.8	0.50	332	3.52	4.02	5.81	69
25-49	1213	42.6	0.51	346	6.07	6.96	9.22	75
50-99	836	58.8	0.49	354	9.77	10.82	12.74	85
100-299	686	116.6	0.44	374	24.88	24.57	25.27	97
300-399	99	33.7	0.41	399	9.05	8.38	7.30	115
400-499	46	20.5	0.43	384	5.06	4.98	4.45	112
500-999	115	79.9	0.40	402	20.16	18.45	17.31	107
1000-1499	29	35.2	0.44	450	8.07	7.99	7.62	105
1500-1999	10	17.5	0.56	496	3.86	4.94	3.80	130
2000-2499	5	11.5	0.37	453	4.63	3.92	2.50	157
2500 and over	5	18.4	0.44	522	4.94	4.96	3.98	125
Other Manufacturing Industries								
11-24	470	8.2	0.46	313	2.36	3.17	3.82	83
25-199	898	62.5	0.43	335	21.29	26.54	29.09	91
200-299	69	17.4	0.43	326	6.00	7.52	8.09	93
300-399	41	14.2	0.45	319	4.72	6.09	6.61	92
400-499	24	10.9	0.48	392	3.82	5.33	5.07	105
500-749	26	15.3	0.39	357	6.53	7.38	7.14	103
750-999	12	10.1	0.42	379	4.03	4.92	4.72	104
1000-1499	18	21.3	0.37	386	9.99	10.68	9.94	107
1500-1999	4	6.7	0.26	422	4.99	3.74	3.10	121

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO (%)	Share in VA (%)	Share in employment (%)	Productivity (average = 100)
2000-2499	4	9.5	0.29	341	4.27	3.58	4.43	81
2500-2999	3	8.5	0.26	430	6.80	5.21	3.98	131
3000 and over	6	30.1	0.22	404	25.20	15.83	14.01	113
				Total Manufacturing				
11-24	16671	291.1	0.35	332	3.22	3.43	4.00	86
25-49	15457	541.4	0.33	340	6.49	6.60	7.44	89
50-99	10792	757.4	0.33	343	9.64	9.61	10.41	92
100-199	6849	956.0	0.33	349	12.76	12.65	13.13	96
200-299	2722	664.3	0.32	350	9.17	9.06	9.13	99
300-399	1415	487.1	0.32	356	7.29	7.07	6.69	106
400-499	795	354.7	0.33	362	5.11	5.08	4.87	104
500-749	1005	609.9	0.33	367	8.65	8.68	8.38	104
750-999	442	378.2	0.34	380	5.36	5.48	5.20	106
1000-1499	435	522.4	0.36	391	6.99	7.68	7.18	107
1500-1999	201	346.7	0.33	395	5.20	5.31	4.76	111
2000-2499	115	257.8	0.36	399	3.43	3.81	3.54	108
2500-2999	72	196.7	0.23	427	4.11	2.93	2.70	109
3000-3999	66	223.3	0.33	409	3.07	3.11	3.07	101
4000-4999	35	155.9	0.27	421	2.66	2.23	2.14	104
5000-7499	36	226.6	0.38	423	2.75	3.17	3.11	102
7500-9999	14	120.4	0.41	408	1.17	1.47	1.65	89
10000 and over	10	188.2	0.44	446	1.94	2.62	2.59	101
unclassified	579	0.9	0.01	546	1.00	0.02	0.01	174

Note: the average net output per employee is set to 100.

Source: own calculations based on Board of Trade (1954) '*The report on the census of Production for 1951*'.

Table A-2.3: Industry information based on the size of establishments 1971

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO	Share in VA	Share in employment	Productivity (average is 100)
Food, Drink and Tobacco								
1-10	1870	9.7					1.22	
11-24	1513	26	} 0.23	} 1109	} 13.43	} 11.57	3.27	} 88
25-99	1295	68.7					8.65	
100-199	452	62.9	0.23	1169	9.00	7.68	7.92	97
200-499	493	157.6	0.27	1202	17.87	18.47	19.83	93
500-999	199	140.6	0.31	1209	15.77	18.12	17.69	102
1000-1499	50	62.2	0.28	1199	6.57	6.99	7.83	89
1500 and over	79	266.9	0.26	1356	37.36	37.17	33.59	111
Coal and Petroleum Products								
1-10	82	0.4					1.07	
11-24	55	0.9	} 0.23	} 1500	} 4.21	} 5.76	2.41	} 63
25-99	39	2.1					5.63	
100-199	21	3.2	0.19	938	5.70	6.69	8.58	78
200-499	34	10.4	0.12	1154	30.92	22.85	27.88	82
500-999	10	7.2	0.25	1167	10.72	16.32	19.30	85
1000 and over	6	13.1	0.17	1221	48.46	48.38	35.12	138
Chemicals								
1-10	1166	5.5					1.33	
11-24	673	11.6	} 0.37	} 710	} 10.41	} 8.75	2.81	} 86
25-99	475	25					6.07	
100-199	212	29	0.39	786	7.15	6.32	7.04	90
200-499	196	62.1	0.40	776	16.39	15.11	15.07	100
500-999	97	65.7	0.44	752	16.65	16.52	15.94	104
1000-1499	32	37.4	0.48	802	6.34	6.95	9.08	77
1500 and over	56	175.8	0.47	907	43.07	46.35	42.66	109
Metal Manufactures								
1-10	822	4.5					0.82	
11-24	719	12.4	} 0.36	} 996	} 7.97	} 8.81	2.27	} 100
25-99	581	31.4					5.75	
100-199	265	37	0.34	1024	6.70	7.02	6.78	104
200-499	224	70.2	0.34	1060	12.70	13.58	12.86	106
500-999	76	54.1	0.31	1079	11.46	11.13	9.91	112
1000-	39	46.5	0.26	1090	11.52	9.21	8.52	108

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO	Share in VA	Share in employment	Productivity (average is 100)
1499								
1500 and over	62	289.9	0.33	1130	49.64	50.26	53.10	95
Mechanical Engineering								
1-10	5817	29.5	0.50	953	18.81	19.60	2.93	92
11-24	3789	64.8	n.a.	n.a.	n.a.	n.a.	6.44	n.a.
25-99	2231	119.3	n.a.	n.a.	n.a.	n.a.	11.86	n.a.
100-199	688	97.7	0.47	905	9.36	9.13	9.71	94
200-499	563	174	0.45	867	17.81	16.68	17.29	96
500-999	250	169	0.47	869	18.89	18.27	16.80	109
1000-1499	72	87.9	0.47	931	9.42	9.22	8.74	106
1500 and over	95	264	0.51	963	25.69	27.10	26.24	103
Instrument Engineering								
1-10	1001	4.7					2.70	
11-24	521	8.8	} 0.54	} 737	} 18.61	} 18.46	5.06	} 102
25-99	317	18					10.34	
100-199	112	15.6	0.54	712	9.06	9.11	8.97	102
200-499	94	29.2	0.57	699	15.93	16.73	16.78	100
500-999	53	39	0.56	687	22.80	23.56	22.41	105
1000-1499	17	20.3	0.53	522	11.26	10.97	11.67	94
1500 and over	14	38.4	0.51	732	22.34	21.17	22.07	96
Electrical Engineering								
1-10	1582	71					0.94	
11-24	995	17	} 0.46	} 722	} 6.93	} 6.83	2.24	} 88
25-99	621	34.5					4.55	
100-199	275	40.4	0.49	752	4.67	4.85	5.33	91
200-499	273	85.3	0.45	661	11.22	10.67	11.26	95
500-999	156	105.9	0.45	743	16.01	15.35	13.98	110
1000-1499	50	64.4	0.44	716	8.69	8.13	8.50	96
1500 and over	107	402.9	0.49	758	52.48	54.17	53.19	102
Shipbuilding and Marine Engineering								
1-10	568	3.2					1.80	
11-24	282	4.9	} 0.51	} 1131	} 9.34	} 9.56	2.76	} 97
25-99	173	9.4					5.30	
100-199	51	7.4	0.60	1189	3.79	4.60	4.17	110

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO	Share in VA	Share in employment	Productivity (average is 100)
200-499	42	14.3	0.49	1266	7.60	7.51	8.07	93
500-999	18	13.8	0.53	1304	8.32	8.81	7.78	113
1000-1499	12	12.8	0.47	1250	7.02	6.71	7.22	93
1500 and over	22	111.5	0.49	1109	63.94	62.82	62.89	100
				Vehicles				
1-10	853	4.9					0.62	
11-24	616	10.5	} 0.42	} 911	} 3.68	} 4.39	1.33	} 91
25-99	421	22.6					2.86	
100-199	180	24.4	0.46	967	2.34	3.07	3.09	99
200-499	151	47.8	0.48	956	5.08	6.93	6.06	114
500-999	79	54.8	0.42	987	5.76	6.91	6.94	100
1000-1499	42	50.7	0.40	1055	6.96	7.81	6.42	122
1500 and over	102	573.5	0.33	1103	76.19	70.89	72.67	98
				Metal Goods not elsewhere specified				
1-10	5677	26.8					4.90	
11-24	3442	58.4	} 0.50	} 904	} 30.33	} 33.43	10.68	} 97
25-99	1972	103.9					19.00	
100-199	524	71.1	0.42	858	13.79	12.74	13.00	98
200-499	336	102.8	0.45	895	19.95	19.59	18.80	104
500-999	118	84.9	0.42	885	16.99	15.70	15.53	101
1000-1499	37	43.9	0.44	918	8.10	7.84	8.03	98
1500 and over	26	55	0.45	936	10.84	10.71	10.06	106
				Textiles				
1-10	1244	6.7					1.09	
11-24	1259	22.4	} 0.35	} 716	} 17.44	} 15.24	3.66	} 90
25-99	1342	74.8					12.21	
100-199	644	91	0.38	769	13.72	12.97	14.86	87
200-499	505	152.6	0.39	798	22.44	22.19	24.91	89
500-999	126	87.3	0.42	795	14.46	15.19	14.25	107
1000-1499	36	42.9	0.41	807	6.20	6.40	7.00	91
1500 and over	44	134.8	0.43	992	25.74	28.01	22.01	127
				Leather, Leather Goods and Fur				
1-10	711	3.9	} 0.37	} 794	}	}	8.65	} 98

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO	Share in VA	Share in employment	Productivity (average is 100)
11-24	373	6.2			54.42	53.76	13.75	
25-99	299	14.7					32.59	
100-199	65	9.2	0.40	859	20.44	21.55	20.40	106
200-499	31	8.7	0.37	828	21.50	21.10	19.29	109
500 and over	4	2.4	0.37	750	3.64	3.59	5.32	67
Clothing and Footwear								
1-10	2472	12.8					2.81	
11-24	1973	34	} 0.44	} 645	} 29.59	} 28.01	7.48	} 97
25-99	1649	84.3					18.54	
100-199	523	73.5	0.46	634	15.11	15.01	16.16	93
200-499	335	105.3	0.46	635	22.37	21.99	23.15	95
500-999	95	63	0.48	641	13.37	13.71	13.85	99
1000-1499	24	26.1	0.48	674	5.94	6.11	5.74	107
1500 and over	17	55.8	0.52	758	13.61	15.17	12.27	124
Bricks, Pottery, Glass, Cement								
1-10	2649	12.9					4.49	
11-24	722	12.6	} 0.44	} 1025	} 25.43	} 21.69	4.39	} 98
25-99	742	38					13.24	
100-199	229	31.5	0.48	1057	12.06	11.25	10.98	102
200-499	175	53.1	0.55	1026	16.43	17.35	18.50	94
500-999	69	45.2	0.54	1024	14.72	15.35	15.75	97
1000-1499	18	22.6	0.60	1062	6.95	8.06	7.87	102
1500 and over	20	71.1	0.56	1076	24.41	26.30	24.77	106
Timber, Furniture etc.								
1-10	4795	24.6					9.39	
11-24	2066	34.7	} 0.39	} 910	} 50.07	} 47.64	13.25	} 92
25-99	1522	76					29.02	
100-199	334	44.9	0.41	935	17.47	17.68	17.14	103
200-499	167	51	0.42	996	20.27	20.72	19.47	106
500-999	33	21.5	0.44	1014	8.08	8.71	8.21	106
1000 and over	7	9.2	0.52	1185	4.11	5.25	3.51	149
Paper, Printing and Publishing								
1-10	5164	27.8					4.69	
11-24	2259	37.9	} 0.53	} 832	} 22.32	} 23.40	6.40	} 87
25-99	1871	94					15.87	

Size - nr. employees	Nr. establishments	Total nr. employees ('000s)	VA/GO	Wages and salaries per employee (£)	Share in GO	Share in VA	Share in employment	Productivity (average is 100)
100-199	518	69.5	0.49	882	11.19	10.87	11.73	93
200-499	422	132.7	0.48	937	23.04	21.88	22.40	98
500-999	138	95.1	0.48	962	16.24	15.43	16.05	96
1000-1499	38	44.9	0.46	1067	8.96	8.13	7.58	107
1500 and over	32	90.5	0.56	1148	18.24	20.28	15.28	133
Other Manufacturing Industries								
1-10	2148	11.1					3.31	
11-24	1075	18.3	} 0.48	} 766	} 19.26	} 18.71	5.45	} 87
25-99	821	42.9					12.79	
100-199	274	40.3	0.49	797	11.60	11.60	12.01	97
200-499	219	67.8	0.46	832	20.98	19.84	20.21	98
500-999	71	49.7	0.49	869	14.77	14.88	14.81	100
1000-1499	13	16.8	0.50	875	3.97	4.06	5.01	81
1500 and over	26	88.6	0.51	991	29.42	30.90	26.41	117
Total Manufacturing								
1-10	38621	196					2.50	
11-24	22332	381.7	} 0.41	} 1185	} 15.62	} 16.23	4.87	} 88
25-99	16371	859.6					10.98	
100-199	5367	748.8	0.39	1208	8.88	8.81	9.56	92
200-499	4260	1325	0.39	1261	16.78	16.44	16.92	97
500-999	1592	1099	0.41	1326	14.30	14.92	14.04	106
1000-1499	487	588.3	0.39	1384	7.50	7.49	7.51	100
1500 and over	708	2632	0.39	1513	36.92	36.10	33.61	107

Note: the number of establishments, and total number of employees is provided for size classes 1-10; 11-24; 25-99, however, no separate information is provided on value added and gross output for these three size classes. Therefore the Value added/gross output, the share in gross output, the share in value added and the productivity measure are provided for the total size class 1 – 99.

Source: own calculations based on Business Statistics Office (1976), '*Report on the census of production – summary tables*', Table 3.

Appendix A3: gaps in the trade statistics

Due to changes in the classification system, and missing values, there are some gaps in the export and import data. This Appendix explains how these gaps were filled. In total there are nine industries for which data is either incomplete for imports, exports or both. The most obvious way of filling gaps is by assuming that exports are closely related to home production, and hence gross output. Of course the volume of exports will also depend on demand side conditions, but considering that there is no easy accessible data for the demand side at the industry level, the most practical solution is to use production information. In most cases I therefore assumed that as a proxy for the missing value, a fixed percentage of gross output could be used. Table A1 below shows for seven industries the share of exports and/or imports in gross output for those years were the data are complete.

Table A-3.1: Exports and imports as a percentage of gross output for industries with missing trade data

year	Wood (basic), (EX)	Wood (manufactured), (EX)	Meat, (EX)	Instrument, optical and precision engineering, (IM)	Instrument, optical and precision engineering, (EX)	Rubber, (IM)	Oil and Greases, (IM)	Oil and Greases, (EX)
1949	0.09	3.99	1.01	-	-	0.16	-	-
1950	0.10	4.24	1.08	-	-	0.13	-	-
1951	0.16	3.54	1.61	-	-	0.15	-	-
1952	0.15	4.50	1.33	-	-	0.16	-	-
1953	0.24	4.79	1.23	-	-	0.22	-	-
1954	0.21	3.38	1.62	11.32	27.95	0.64	105.01	18.81
1955	0.24	3.79	1.71	11.51	27.46	0.80	112.38	21.02
1956	0.31	3.82	2.16	11.66	27.83	0.97	99.29	16.59
1957	0.31	3.74	2.58	11.33	27.69	0.93	93.17	11.73
1958	0.41	4.02	2.48	13.56	26.89	0.97	72.05	9.40
1959	0.42	3.19	1.71	13.76	22.89	1.39	79.71	12.56
1960	0.40	3.39	1.74	17.20	24.09	1.78	79.02	9.54
1961	0.34	3.78	1.88	18.37	23.96	2.05	72.26	8.74
1962	0.37	4.09	1.82	17.12	24.12	1.98	59.26	9.53
1963	-	-	-	18.44	25.70	-	63.14	11.50
1964	-	-	-	19.48	26.09	-	74.42	8.04
1965	-	-	-	19.42	27.09	-	84.81	8.80
1966	-	-	-	18.47	26.87	-	80.84	7.76
1967	-	-	-	21.10	26.06	-	77.54	7.39
1968	-	-	-	21.20	28.47	-	83.93	8.91
1969	-	-	-	19.52	31.83	-	90.83	11.55
1970	-	-	-	21.77	32.09	-	118.45	10.93
r [a]	0.946 (< 0.001)	0.887 (<0.001)	0.915 (< 0.001)	0.9964 (<0.001)	0.9885 (<0.001)	0.862 (<0.001)	0.546 (0.023)	-0.478 (0.052)
Percentage used to guesstimate missing years	0.4	4	1.8	11	27	2	100	18

a) Information is provided on the correlation between exports and gross output or imports and gross output. Which correlation is presented is depending on whether the heading specifies imports or exports as a share of gross output.

The years in between census years have been interpolated using the annual index of production from the 'Annual Abstract of Statistics', for more detail see Appendix Table A-3.7.

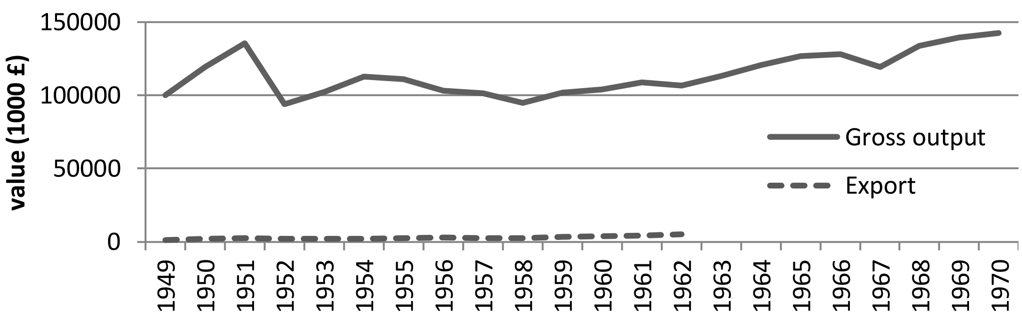
Sources: different volumes from the *'Report on overseas trade'* published by the Board of Trade; Business Statistics Office (1978), '*Historical Record of the Census of Production 1907-1970'*, Table 1.

Based on information on the exports to gross output, and imports to gross output ratio I constructed a guesstimate percentage to fill the gaps for the missing years. For wood (basic), wood (manufacturing), optical, precision and instrument engineering, and rubber, the correlation between exports (and/or imports) and gross output in that industry is very high and highly significant. This implies that it seems plausible to use a fixed percentage of gross output as a guesstimate for the missing values in the trade data. The last row shows the percentage used to construct the guesstimate for the missing years.

Leather (basic materials)

For leather (basic materials) the correlation between gross output and exports was very low and insignificant. Therefore, I choose to use a different approach here. Figure A1 below shows gross output and exports in the leather (basic materials) industry. Clearly, there are some severe changes in gross output over the years, whereas exports are growing at a slow but constant rate. There is no direct relation between the movement in exports and the movement in gross output. There is also no significant correlation between imports and exports of leather (basic materials) There is a significant correlation however between exports of leather (manufactured) and exports of leather (basic materials) (0.9023, p-value <0.001). Table A2 shows exports of leather (basic materials) as a percentage of exports of leather (manufacturing). I use a fixed percentage of exports of leather (manufactured) to estimate the missing values for leather (basic materials).

Figure A-3. 1: Gross output and exports in the leather (basic materials) industry



Sources: own calculations based on Business Statistics Office (1978), '*Historical Record of the Census of Production 1907-1970*', Table 1. '*Report on overseas trade*' different volumes. The years in between census years have been interpolated using the annual index of production derived from various volumes of the '*Annual Abstract of Statistics'*, for more detail see Appendix Table A 3.7.

Table A-3.2: Exports of leather (basic materials) as a percentage of exports of leather (manufactured)

Year	Exports of leather (basic materials) as a percentage of exports of leather (manufactured)
1949	12.85
1950	11.45
1951	14.80
1952	13.41
1953	15.04
1954	12.77
1955	13.57
1956	13.94
1957	12.08
1958	12.94
1959	13.44
1960	16.45
1961	16.94
1962	19.93
Correlation between exports leather (basic materials) and exports leather (manufactured); p-value between brackets	0.902 (<0.001)
Percentage used to guesstimate the gap	19

Source: own calculation based on '*Report on overseas trade'*, different volumes.

Clothing and footwear

From 1954 to 1963 the industry classification in the trade statistics clothing and footwear are combined. Table A3 below shows the share of gross output, value added and exports and imports of footwear in the industry footwear and clothing from 1949 till 1970. The share of footwear in the exports of the branch clothing and footwear seems to be reasonably constant around 24-25 per cent per annum. Therefore, I assume that for the years 1954 till 1962 the share of footwear in exports of this group of products was also 25 per cent. For imports constructing a proxy is slightly more difficult, since in 1953, the last year we have separate information for footwear and clothing, the ratio of footwear in total imports is much higher than the years before, 36 per cent instead of the 24 per cent in 1952. In 1963, the first year we have information on the industries after the data gap; the ratio is back to 23 per cent, which seems in line with the years following. There was no change in the share of footwear in value added or gross output of clothing and footwear from domestic production. Therefore, I assume that the 36 per cent of 1953 might be a positive outlier, and imports of footwear are assumed to be 25 per cent of the total value of imports of clothing and footwear.

Table A-3.3: The share of footwear in the footwear and clothing industry

Year	Share of footwear, in gross output of clothing and footwear	Share of footwear in value added of clothing and footwear	Share of footwear in imports of clothing and footwear	Share of footwear in exports of clothing and footwear
1949	0.26	0.25	0.31	0.17
1950	0.24	0.24	0.21	0.21
1951	0.25	0.24	0.28	0.23
1952	0.24	0.24	0.24	0.25
1953	0.23	0.24	0.36	0.27
1954	0.23	0.24	-	-
1955	0.22	0.23	-	-
1956	0.22	0.25	-	-
1957	0.22	0.25	-	-
1958	0.23	0.24	-	-
1959	0.23	0.25	-	-
1960	0.24	0.25	-	-
1961	0.24	0.26	-	-
1962	0.24	0.26	-	-
1963	0.24	0.26	0.23	0.25
1964	0.24	0.26	0.24	0.25
1965	0.24	0.26	0.24	0.24
1966	0.24	0.26	0.25	0.24
1967	0.24	0.26	0.24	0.24
1968	0.24	0.26	0.23	0.24
1969	0.24	0.26	0.22	0.24
1970	0.24	0.25	0.24	0.22

The years in between census years have been interpolated using the annual index of production from the *Annual Abstract of Statistics*, for more detail see Appendix Table A-3.7.

Source: own calculations based on Business Statistics Office (1978), '*Historical Record of the Census of Production 1907-1970'*, Table 1 and *'Report on overseas trade'*, different volumes.

Paper pulp

The trade statistics offer two entries for the paper industry; the first is paper (manufactured), and the second paper pulp. Export data for paper pulp for the period 1963-1970 is not provided in the trade statistics. The census of production, however, does not allow a distinction between these two paper industries. Therefore I combined the two paper industries to form the complete paper industry. We cannot rely on a percentage of gross output in the paper pulp industry to construct an estimate of the missing data. Therefore, I instead use the ratio of paper pulp exports to paper (manufactured) exports. Table A4 below shows this ratio for the period 1949 to 1962.

Table A-3. 4: Ratio of paper pulp to paper (manufactured) exports

Year	Exports of paper pulp as a percentage of exports of paper manufactures
1949	2.17
1950	5.06
1951	3.73
1952	4.24
1953	5.12
1954	2.67
1955	2.92
1956	3.86
1957	4.40
1958	3.81
1959	3.19
1960	4.00
1961	4.84
1962	4.01
Correlation between exports of paper *manufactured) and exports of paper pulp, p-value between brackets)	0.723 (0.004)
Percentage used to guesstimate the gap	4

Source: own calculations based various volumes of '*Report on overseas trade*'.

Table A-3. 5: Gaps in the wholesale price index

Industry	Missing year(s)	Data used to interpolate	Detail
Food Industry	1950	Retail price index number for Food, (Appendix II, iii, part 2, *Historical record of the census of production 1907 to 1970*)	Between 1949 and 1951 growth in the wholesale prices was 18 per cent, and growth in the retail prices was 18.9 per cent. The missing value for 1950 is interpolated using the same interpolation technique as used for value added, gross output, and employment, which is described in detail im Table A-3.7.
Mechanical Engineering	1949-1953	Wholesale price index numbers for 'mechanical engineering' are taken from the *Annual Abstract of Statistics* (1958)	For the overlapping period (1954-1956) the index numbers in the annual abstract of statistics show the exact same growth patterns as the index numbers from the census
Electrical Engineering	1949-1953	Wholesale price index numbers for 'electrical machinery' are taken from the *Annual Abstract of Statistics* (1958)	Electrical machinery is only a subset of electrical engineering. In 1951, electrical machinery composed 30 per cent of value added in electrical engineering, and in 1954 this was 33 per cent.[a]
Engineering and Allied Industries	1949-1953	I approximate the index for engineering and allied industries by taking 50% of the mechanical engineering index, and 50% of the electrical engineering index.	Engineering and allied industries contains more than just electrical and mechanical engineering. However, there only exists an index for those two industries. The approximation works very precise for the years 1954-1970. The deviation between the constructed index and the actual index is never more than 3 per cent. The constructed index is only used for 1949 to 1953.
Textiles	1949-1963	Wholesale price index numbers for 'textiles' are taken from the *Annual Abstract of Statistics* 1958	
Timber	1949-1953	The wholesale number for 'products other than food' is used	

Notes: a. own calculation from Business Statistics Office (1978).

Sources: Business Statistics Office (1978), '*Historical record of the Census of Production 1907-1970*', '*Annual Abstract of Statistics*', different volumes.

Table A-3.6: Reclassification of industries from the '*Historical Record of the Census of Production 1907-1970*'

1	**Dairy Industry**
	Milk and Milk Products
2	**Fruits and Vegetables**
	Fruit and Vegetable Products
3	**Meat Industry**
	Bacon Curing, Meat and Fish Products
4	**Tobacco**
	Tobacco
5	**Beverages**
	Brewing and Malting; Soft Drinks; Spirit Distilling and Compounding; British Wines, Cider and Perry
6	**Textiles (basic materials)**
	Production of Man-made Fibre; Spinning and Doubling on the Cotton and Flax Systems; Weaving of Cotton, Linens and Man-made Fibres; Woollen and Worsted; Jute; Rope, Twine, Net
7	**Textiles (manufacturing)**
	Hosiery and Other Knitted Goods; Lace; Carpets; Narrow Fabrics; Made-up Household Textiles; Canvas Goods and Sacks; Textile Finishing; Asbestos; Miscellaneous Textiles
8	**Clothing**
	Weatherproof Outerwear; Men's and Boys' Tailored Outerwear; Women's and Girl's Tailored Outerwear; Overalls and Men's Shirts, Underwear etc.; Dresses, Lingerie, Infant's Wear etc.; Hats, Caps and Millinery; Corsets and Miscellaneous Dress Industry; Gloves
9	**Footwear**
	Footwear
10	**Leather (basic materials)**
	Leather (tanning and dressing) and Fellmongery
11	**Leather and fur (manufactured)**
	Leather Goods; Fur
12	**Chemicals**
	Chemicals and Allied Industries (general chemicals, inorganic, organic and other); Drugs and Pharmaceutical Preparations; Toilet Preparations and Perfumery; Paint and Varnish; Soap and Detergent; Synthetic Resins and Plastic Materials and Synthetic Rubber; Dyestuffs and Pigments; Fertilizers; Polishes; Formulated Adhesives, Gelatine etc.; Explosives and Fireworks; Formulated Pesticides and Disinfectants; Printing Ink; Surgical Bandages; Photographic Chemical Materials
13	**Lubricating oil and greases**
	Lubricating Oil and Greases
14	**Transport equipment**
	Wheeled Tractor Manufacturing; Motor Vehicle Manufacturing; Motor Cycle, Tricycle and Pedal Cycle Manufacturing; Aerospace Equipment Manufacturing and Repairing;

	Locomotive and Railway Tract Equipment; Railway Carriages, Wagons and Trams; Shipbuilding
15	**Iron and steel (manufactured)**
	Iron and Steel; Steel Tubes; Iron Castings etc.; Engineer's Small Tools and Gauges; Hand Tools and Implement; Cutlery; Bolts, Nuts, Screws, Rivets, etc.; Wire and Wire Manufacturing; Cans and Metal Boxes; Metal Furniture; Drop Forging etc.; Metal Hollow-ware; Miscellaneous Metal Goods
16	**Non-ferrous metals**
	Aluminium and Aluminium Alloys; Copper, Brass and other Copper Alloys
17	**Rubber**
	Rubber
18	**Mechanical Engineering**
	Agricultural Machinery; Metal Working Machine Tools; Pumps, Valves and Compressors; Industrial Engines; Textile Machinery and Accessories; Construction and Earthmoving Equipment; Mechanical Handling Equipment; Office Machinery; Mining Machinery; Printing and Bookbinding Machinery; Refrigerator Machinery; Space Heating, Ventilating and Air-conditioning Equipment; Food and Drink Processing Machinery; Miscellaneous Machinery; Industrial Plant and Steel Work; Ordnance and Small Arms; General Mechanical Engineering
19	**Electrical Engineering**
	Electrical Machinery; Insulated Wires and Cables; Telegraph and Telephone Apparatus and Equipment; Radio and Electronic Components; Broadcasting Receiving and Sound Reproducing Equipment; Electronic Computers; Radio, Radar and Electronic Capital Goods; Electric Appliances Primarily for Domestic Use; Miscellaneous Electrical Goods
20	**Optical and precision engineering**
	Photographic and Document Copying Equipment; Watch and Clock; Surgical Instrument and Appliances; Scientific and Industrial Instruments and Systems
21	**Wood (basic materials)**
	Timber; Miscellaneous Wood and Cork
22	**wood (manufactured)**
	Shop and Office Fittings; Wooden Containers and Baskets
23	**Paper**
	Paper and Board; Cardboard Boxes, Cartons and Fibre-board Packing Cases; Packaging Products of Paper and associated Materials; Manufactured Stationery; Miscellaneous Manufacturing of Paper and Board

Source: own reclassification, industries from the Business Statistics Office (1978), '*Historical record of the Census of Production 1907-1970'*, Table 1.

Table A-3.7: Interpolation method

The missing data for the years in between the census years, point t_0 and t_n, are interpolated using the following formula's:

$$VA_{t+1} = (EXP(LN(\frac{VA_{tn}}{VA_{t0}})/time)\ /EXP(LN(\frac{I_{tn}}{I_{t0}})/time)) \times (\frac{I_{t+1}}{I_t} * VA_t) \quad \text{(A.1)}$$

$$GO = (EXP(LN(\frac{GO_{tn}}{GO_{t0}})/time)\ /EXP(LN(\frac{I_{tn}}{I_{t0}})/time)) \times (\frac{I_{t+1}}{I_t} * VA_t) \quad \text{(A.2)}$$

$$L_{t+1} = (EXP(LN(\frac{L_{tn}}{L_{t0}})/time)\ /EXP(LN(\frac{IE_{tn}}{I_{Et0}})/time)) \times (\frac{IE_{t+1}}{I_{Et}} * VA_t) \quad \text{(A.3)}$$

Were VA is value added, GO is gross output, L is employment, I is the industrial index of production and IE is the index of employment.

This method takes both the growth rate of the yearly index, and the total growth rate of the actual data into account.

Table A-3.8: Reclassifying the 1950 labour-productivity estimates US/UK

Industry	Industries included (ISIC code)	GAP US/UK (per worker)	Gap US/UK per hour worked
Meat Industry	2010. Bacon, Sausage , and Canned Meat	157	150
Dairy Industry	2020. Dairy products	183	176
Fruits and vegetables	2030. Canning and Preserving of Fruits and Vegetables	235	226
Tobacco	22. Tobacco Manufactures	251	240
Beverages	21. Beverage	266	255
Leather and fur (manufactured)	2920. Leather Products, except Footwear and Apparel	192	194
Paper (manufactured)	27. Paper and Paper Products	389	405
Wood (basic materials)	2510. Lumber and Timber (basic products)	298	306
Wood (manufactured)[1]	2610. Furniture and Upholstery	254	261
Leather (basic materials)	2910. Tanneries and Leather Finishing Plants	168	169
Non-ferrous metals (manufactured goods)	3420. Non-Ferrous Metal Basic Industries	264	274
Animal oils and vegetable oils, fats, greases and derivatives (basic materials)	3120. Oils, Fats and Greases	235	240
Textile fibres (basic materials)	2311/12. Cotton Spinning and Weaving; 2313. Woollen and Worsted; 2314. Rayon, Nylon and Silk	225	220
Rubber (manufactured)	3010. Tires and Tubes; 3020. Other Rubber Products	246	250
Clothing	2431/33.Men's, Boys', Women's and Girls'; Outerwear and Underwear, Infants' Wear; 2435. Gloves; 2437. Hats, Caps and Millinery	176	177
Footwear	2410. Footwear Except Rubber; 3020. Rubber Footwear	167	168
Iron and steel (manufactured)	3411. Blast Furnaces; 3412. Steel Works and Rolling Mills; 3413.Iron and Steel Foundries; 3430. Wire Drawing; 3510. Metal Cans; 3521 Cutlery; 3522. Tools and Implement; 3530. Heating, Cooking and Plumbing Equipment; 3541. Structural Iron and Steel; 3551.	298	310

	Steel Metal Work and Metal Stampings; 3571. Wirework; 3572. Needles, Pins, and Metal Small-Ware; 3581. Bolts, Nuts, Rivets, etc.		
Electrical Engineering	37. Electrical Machinery, Apparatus, Appliances and Supplies	321	328
Mechanical Engineering	36. Machinery, except Electrical Machinery	322	345
Chemicals	3111. Basic Industrial Chemicals, Including Fertilizers and Plastic Materials; 3191. Medicinal and Pharmaceutical Preparations; 3192. Soap, Candles and Glycerine; 3194. Paint and Varnish; 3197. Matches	374	381
Textiles (manufactured)	2317. Carpets; 2320. Knitting Mills	188	184
Transport equipment	38A. Automobiles, Trucks and Tractors; 38B. Transport Equipment other than Automobiles, Trucks and Tractors	349	367
Optical and precision engineering[2]		322	323

1. There is no separate entry for manufactured wood, other than furniture, thus the gap for furniture and upholstery is taken here to represent and proxy also the gap for manufactured wood excluding furniture.
2. Paige and Bombach do not provide an estimate for optical and precision engineering, as a proxy for this gap the gap for mechanical engineering is used.

Source: own reclassification and calculation based on Paige and Bombach (1959), Table 7, p. 30, Table 9, p. 33, and Appendix pp. 130-186.

Table A-3.9: First stage estimation results, industry and year dummies included

Dependent variable MS		t-statistic
L2.MS	0.671*** (0.091)	7.41
L2.XGO	-0.197** (0.907)	-2.17
L2.DTF	-0.004 (0.004)	-0.95
nr. obs.	437	
Adj. R-squared	0.9622	
Dependent variable XGO		**t-statistic**
L2.MS	0.027 (0.036)	0.76
L2.XGO	0.695*** (0.051)	13.59
L2.DTF	0.001 (0.002)	0.29
nr. obs.	437	
Adj. R-squared	0.972	
Dependent variable DTF		**t-statistic**
L2.MS	10.175 (28.58)	0.36
L2.XGO	-86.389 (31.620)	-2.73
L2.DTF	0.499*** (0.069)	7.22
nr. obs.	437	
Adj. R-squared	0.878	

Robust standard errors in parentheses. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

Table A-3.10: First stage estimation results, industry and year dummies included (Moving averages)

Dependent variable MS		t-statistic
L2.moving average - MS	0.918*** (0.061)	15.04
L2.moving average - XGO	-0.275 (0.077)	-3.56
L2.DTF	-0.004 (0.003)	-1.18
nr. obs.	437	
Adj. R-squared	0.974	
Dependent variable XGO		**t-statistic**
L2.moving average - MS	0.075*** (0.024)	3.19
L2.moving average - XGO	0.740*** (0.038)	19.39
L2.DTF	0.001 (0.002)	0.59
nr. obs.	437	
Adj. R-squared	0.979	
Dependent variable DTF		**t-statistic**
L2.moving average - MS	0.332 (0.305)	1.09
L2.moving average - XGO	-0.938** (0.314)	-2.99
L2.DTF	0.498*** (0.069)	7.20
nr. obs.	437	
Adj. R-squared	0.878	

Robust standard errors in parentheses. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

Table A-3.11: Instrumental variable estimation. Three- and four-year moving averages

	Dependent variable: *LP* growth rate			
	1[a]	2	3[c]	4
YGO	0.267*** (0.073)	0.223*** (0.069)	0.241*** (0.064)	0.204*** (0.060)
MS	0.130 (0.08)	0.147* (0.083)	0.068 (0.061)	0.081 (0.056)
DTF	0.073*** (0.015)	0.061*** (0.012)	0.073*** (0.015)	0.060*** (0.012)
Constant	-0.288*** (0.060)	-0.243*** (0.052)	-0.269*** (0.057)	-0.225*** (0.048)
Wald chi-square (p-value)	211.17 (<0.001)	236.11 (<0.001)	215.31 (<0.001)	240.59 (<0.001)
N	414	391	414	391

Results of time and fixed effects are suppressed. The reported R-squared is obtained by performing a dummies regression. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

Column 1: three-year moving average of *LP* growth rate, *MS*, *XY* and, *DTF* as instruments
Column 2: three-year moving average of *LP* growth rate, and a three-year moving average of *MS* and *XY* as instruments)
Column 3: four-year moving average of *LP* growth rate, *MS*, *XY* and, *DTF* as instruments
Column 4: four-year moving average of *LP* growth rate, and a three-year moving average of *MS* and *XY* as instruments)

Robust standard errors in parenthesis. Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

Table A-3.12: The geographical composition of Britain's exports in manufacturing industries (1950-1970)

	Sterling Area	US	Canada	Eastern Europe	Rest of the world
Exports 1950					
Tobacco Industry	76.35	0.19	0.19	0.12	23.16
Chemicals	34.07	3.99	2.61	1.58	57.75
Paper and Board (manufactured)	66.99	3.68	1.70	0.24	27.39
Textiles (manufactured)	55.64	6.11	8.11	2.17	27.97
Leather (manufactured)	20.71	19.74	10.69	0.37	48.49
Mechanical Engineering	49.02	1.21	2.88	6.03	40.85
Electrical Engineering	36.37	0.58	1.36	1.21	60.48
Rubber (manufactured)	46.19	3.53	2.12	1.27	46.89
Iron and Steel	56.44	1.98	5.86	2.63	33.09
Non-Ferrous Metals	46.45	21.10	14.64	3.89	13.92
Transport Equipment	48.63	2.44	7.84	1.04	40.05
Clothing and Footwear	47.71	9.98	7.93	0.42	33.96
Optical and Precision Engineering	n.a.	n.a.	n.a.	n.a.	n.a.
Exports 1955					
Tobacco Industry	73.57	0.30	0.40	0.05	25.67
Chemicals	50.48	3.27	3.35	0.58	42.33
Paper and Board (manufactured)	73.72	3.94	1.61	0.19	20.55
Textiles (manufactured)	53.39	8.19	7.12	0.31	30.98
Leather (manufactured)	21.31	14.78	8.71	0.00	55.21
Mechanical Engineering	47.56	3.18	4.02	1.64	43.60
Electrical Engineering	60.77	2.79	4.35	2.33	29.76
Rubber (manufactured)	50.14	0.99	1.29	1.19	46.39
Iron and Steel	54.80	2.24	4.97	0.08	37.91
Non-Ferrous Metals	26.64	14.43	2.57	14.06	42.30
Transport Equipment	54.70	5.27	3.91	0.13	35.99
Clothing and Footwear	46.95	14.86	9.70	0.08	28.42
Optical and Precision Engineering	48.58	3.78	2.76	0.31	44.58
Exports 1960					
Tobacco Industry	65.04	0.79	0.59	0.07	33.51
Chemicals	43.87	3.35	2.97	3.54	46.27
Paper and Board (manufactured)	63.69	3.39	2.12	0.85	29.95
Textiles (manufactured)	47.66	8.08	8.22	0.75	35.29
Leather (manufactured)	17.80	19.50	8.90	0.26	53.54
Mechanical Engineering	35.84	6.90	5.67	3.95	47.63
Electrical Engineering	51.72	5.41	5.61	1.38	35.89
Rubber (manufactured)	45.79	2.76	2.51	1.04	47.90
Iron and Steel	37.90	6.24	5.79	4.77	45.31

	Sterling Area	US	Canada	Eastern Europe	Rest of the world
Non-Ferrous Metals	24.55	11.38	2.37	7.64	54.06
Transport Equipment	43.26	13.76	8.67	0.13	34.18
Clothing and Footwear	38.26	19.87	9.96	1.89	30.01
Optical and Precision Engineering	38.58	7.41	4.68	2.07	47.27
Exports 1965					
Tobacco Industry	45.56	1.38	0.84	0.18	52.04
Chemicals	36.92	4.20	2.58	4.63	51.68
Paper and Board (manufactured)	52.49	2.53	1.55	1.64	41.80
Textiles (manufactured)	37.38	8.36	6.25	2.14	45.87
Leather (manufactured)	14.67	18.30	7.81	0.71	58.52
Mechanical Engineering	35.52	6.55	4.74	3.50	49.70
Electrical Engineering	47.76	3.79	4.17	1.87	42.40
Rubber (manufactured)	39.51	2.77	2.51	1.77	53.44
Iron and Steel	32.12	13.48	5.66	3.10	45.63
Non-Ferrous Metals	16.05	10.41	3.96	5.64	63.94
Transport Equipment	40.59	13.07	3.23	0.24	42.86
Clothing and Footwear	27.83	20.11	6.27	3.63	42.15
Optical and Precision Engineering	29.73	7.51	4.03	2.40	56.33
Exports 1970					
Tobacco Industry	32.21	1.17	0.69	0.42	65.52
Chemicals	30.64	4.12	2.24	4.63	58.37
Paper and Board (manufactured)	42.80	2.47	1.68	2.26	50.79
Textiles (manufactured)	29.73	5.73	6.14	4.28	54.12
Leather (manufactured)	15.92	15.11	8.32	1.18	59.46
Mechanical Engineering	26.67	9.73	3.95	5.04	54.61
Electrical Engineering	35.81	6.91	3.97	2.71	50.60
Rubber (manufactured)	29.23	4.55	3.21	1.59	61.42
Iron and Steel	24.69	14.17	3.95	3.68	53.51
Non-Ferrous Metals	9.43	9.89	1.28	7.37	72.04
Transport Equipment	32.75	13.13	2.74	0.46	50.91
Clothing and Footwear	22.08	16.09	5.25	6.57	50.00
Optical and Precision Engineering	20.08	10.91	5.54	3.95	59.53

Source: own calculations based on various volumes of the ‘*Report on overseas trade*’.

Table A-3.13: The geographical composition of Britain's imports in manufacturing industries (1950-1970)

	Sterling Area	U.S.A.	Canada	Eastern Europe	Rest of the world
Imports 1950					
Tobacco Industry	38.61	51.19	4.46	0.02	5.72
Meat Industry	34.59	0.04	4.72	6.43	54.22
Fruits and Vegetables Industry	20.96	0.43	1.36	0.26	76.99
Leather (basic materials)	41.97	4.99	3.56	8.65	40.83
Wood (basic materials)	11.64	3.27	11.22	37.35	36.52
Textiles (basic materiasl)	54.54	10.35	0.07	0.23	34.81
Paper	0.87	2.20	6.42	22.05	68.45
Iron and Steel	1.74	17.90	7.91	0.92	71.54
Chemicals	6.35	15.29	2.36	0.40	75.60
Textile (manufactured)	35.16	1.10	0.53	3.23	59.99
Leather (manufactured)	87.21	0.26	2.05	0.00	10.49
Mechanical Engineering	3.36	53.13	1.64	0.52	41.35
Imports 1955					
Tobacco Industry	29.95	53.27	10.53	0.00	6.25
Meat Industry	44.74	0.97	0.13	3.66	50.50
Fruits and Vegetables Industry	43.06	3.78	1.02	0.63	51.51
Leather (basic materials)	39.08	11.72	5.06	11.30	32.83
Wood (basic materials)	8.17	1.77	22.23	16.20	51.62
Textiles (basic materials)	62.67	8.82	0.16	2.27	26.08
Paper	1.71	9.73	17.65	2.14	68.78
Iron and Steel	1.24	37.76	5.44	5.54	50.02
Chemicals	9.20	23.16	7.67	2.94	57.02
Textile (manufactured)	41.20	1.25	0.37	0.37	56.81
Leather (manufactured)	72.53	0.68	3.54	6.75	16.50
Mechanical Engineering	5.09	34.46	2.10	0.46	57.90
Imports 1960					
Tobacco Industry	36.89	51.76	8.14		3.20
Meat Industry	37.71	1.56	0.49	4.71	55.54
Fruits and Vegetables Industry	37.50	7.14	1.41	0.96	52.99
Leather (basic materials)	32.95	8.41	5.24	23.42	29.98
Wood (basic materials)	10.72	2.87	16.14	20.73	49.54
Textiles (basic materials)	55.84	13.62	0.59	2.17	27.78
Paper	2.89	11.79	20.41	1.99	62.92
Iron and Steel	5.16	24.63	13.09	1.76	55.35
Chemicals	5.68	28.76	6.42	3.76	55.37
Textile (manufactured)	37.37	6.55	1.21	1.51	53.36
Leather (manufactured)					

	Sterling Area	U.S.A.	Canada	Eastern Europe	Rest of the world
Mechanical Engineering	5.93	33.35	3.33	0.54	56.85
Imports 1965					
Tobacco Industry	42.04	40.51	12.13	0.01	5.30
Meat Industry	43.88	1.83	0.53	5.16	48.61
Fruits and Vegetables Industry	38.74	6.23	2.91	1.58	50.54
Leather (basic materials)	34.45	9.10	11.12	16.28	29.05
Wood (basic materials)	8.50	1.72	21.85	29.28	38.66
Textiles (basic materials)	50.55	6.41	0.22	2.70	40.13
Paper	3.87	10.41	17.53	1.71	66.48
Iron and Steel	7.00	9.88	5.99	8.44	68.69
Chemicals	5.75	25.39	5.53	3.34	59.99
Textile (manufactured)	36.28	7.77	2.79	2.45	50.72
Leather (manufactured)	62.44	6.48	2.51	7.35	21.22
Mechanical Engineering	3.24	34.20	2.61	0.75	59.21
Imports 1970					
Tobacco Industry	23.28	51.35	14.82	0.00	10.55
Meat Industry	42.39	2.01	0.73	5.21	49.66
Fruits and Vegetables Industry	35.75	5.06	2.43	1.98	54.78
Leather (basic materials)	39.83	7.90	4.09	13.08	35.09
Wood (basic materials)	7.79	2.28	16.83	25.26	47.83
Textiles (basic materials)	45.22	5.23	0.03	2.79	46.74
Paper	3.79	11.25	17.75	0.60	66.59
Iron and Steel	2.42	22.82	6.11	3.67	64.98
Chemicals	7.66	20.62	6.19	2.53	63.00
Textile (manufactured)	28.42	7.51	3.46	2.13	58.47
Leather (manufactured)	57.07	2.59	2.51	7.72	30.11
Mechanical Engineering	6.72	55.11	4.49	1.59	32.09

Source: own calculations based on various volumes of the '*Report on overseas trade*'.

Table A-3.14: Pairwise correlations

	XY – Sterling Area	XY-US	XY – Canada	XY – Eastern Europe
XY – Sterling Area	1.000			
XY-US	0.296***	1.000		
XY – Canada	0.650***	0.848***	1.000	
XY – Eastern Europe	0.001	0.212***	0.061	1.000
	MS – Sterling Area	MS-US	MS – Canada	MS – Eastern Europe
MS – Sterling Area	1.00			
MS-US	-0.254***	1.00		
MS – Canada	-0.156**	-0.068	1.00	
MS – Eastern Europe	0.168***	-0.215***	0.578***	1.00

Estimates marked ***/**/* are significant at the 1/5/10 per cent level.

Nederlandse Samenvatting

De wetenschappelijke literatuur over de economische prestaties van het Verenigd Koninkrijk zowel voor als na de tweede wereldoorlog wordt gekenmerkt door één terugkerend onderwerp: relatieve economische achteruitgang. Vooral in de literatuur over de naoorlogse periode wordt relatieve economische achteruitgang gezien als het resultaat van pathologisch falen van het Verenigd Koninkrijk, en niet als het onvermijdelijke resultaat van globaal kapitalisme en economische groei in andere naties.

Tijdens de *golden age of economic growth*, de periode 1950-1973, was economische groei in Engeland ongewoon laag in vergelijking met de groei in andere ontwikkelde landen. Dit is een indicatie dat Engeland werd geconfronteerd met relatieve economische achteruitgang.

De verklaringen hiervoor lopen uiteen van institutionele oorzaken tot verklaringen met betrekking tot de effecten van macro-economisch beleid en *catch-up*- en convergentie-theorieën. De meest bekende verklaring van Engelands relatieve economische achteruitgang heeft zich ontwikkeld rond het standpunt van Stephen Broadberry en Nick Crafts, de zogeheten '*manufacturing failure hypothesis*'.

In hoofdstuk 1 van dit proefschrift wordt een aantal belangrijke vragen gesteld over de oorzaak en de aard van Engelands relatieve economische achteruitgang. De eerste vraag is of er sprake was van falen in de maakindustrie. Om antwoord op deze vraag te kunnen geven heb ik onderzocht welke industrieën het meest hebben bijgedragen aan de relatieve economische achteruitgang.

Dit proefschrift begint met een gedetailleerd overzicht van de ontwikkeling van de comparatieve arbeidsproductiviteit in Engeland en West-Duitsland gedurende de periode 1935-1968. In hoofdstuk 2 heb ik een gedesaggregeerde vergelijking van de arbeidsproductiviteit opgesteld van deze landen voor 1951. Ik heb een bestaande schatting voor 1935 van Fremdling et al (2007a) substantieel herzien om deze direct vergelijkbaar te maken met een nieuwe schatting voor de naoorlogse periode. Tenslotte heb ik gebruik gemaakt van een bestaande arbeidsproductiviteitsschatting van Smith et al (1982) om te evalueren hoe de posities van Engeland en West-Duitsland zich tot elkaar verhielden aan het einde van de *golden age of economic growth*. Door deze drie schattingen tezamen te evalueren is het mogelijk om een compleet beeld te vormen van Engelands relatieve prestaties vanaf het interbellum tot aan het einde van de jaren zestig.

De gegevens wijzen uit dat West-Duitsland een substantieel hoger niveau van arbeidsproductiviteit had ten opzichte van Engeland tijdens het interbellum. In de periode na de Tweede Wereldoorlog is dit patroon compleet omgedraaid. Engeland was productiever in vrijwel alle industrieën. West-Duitsland behield echter wel haar leidende positie in de ijzer- en staal industrie. Het duurde echter maar tot het einde van de jaren vijftig voor West-Duitsland er in slaagde om de leidende positie in arbeidsproductiviteit weer over te nemen van Engeland. Volgens de schattingen van Smith et al. was West-Duitsland 23 procent productiever dan Engeland in 1968.

In hoofdstuk 3 wordt shift-share analyse toegepast om te onderzoeken of het totale verschil in arbeidsproductiviteit in de maakindustrie tussen Engeland en West- Duitsland het resultaat was van intra-sectorale effecten, of van het verschil in de structuur van de industrie. Voor zowel 1935 als 1951 wijst de analyse uit dat verschillen in arbeidsproductiviteit op het niveau van de afzonderlijke industrieën de belangrijkste oorzaak waren voor het totale verschil. De structuur van de industrie blijkt daardoor geen cruciale rol te spelen in het verklaren van het totale verschil in arbeidsproductiviteit.

Het grote voordeel van mijn nieuwe, sterk gedesaggregeerde dataset van de arbeidsproductiviteit is dat deze data ons in staat stellen om te onderzoeken wat het aandeel is van afzonderlijke industrieën in het totale verschil in arbeidsproductiviteit in de industrie. Het is cruciaal om het belang van individuele industrieën te begrijpen als we willen beargumenteren of Engeland faalde of niet. Voor West Duitsland vinden we met name een sterke achteruitgang van de belangrijke oorlogsindustrieën, zoals de ijzer en staalindustrie, de metaalproductie, machinale gereedschappen, transportmiddelen en elektrische apparaten en de chemische industrie. Maar de belangrijke en enigszins atypische tabaksindustrie was verantwoordelijk voor bijna de helft van het totale verschil in arbeidsproductiviteit in de totale maakindustrie in 1951. Engeland produceerde voornamelijk sigaretten, via een zeer kapitaalintensief productieproces, terwijl West-Duitsland zich vooral richtte op de veel arbeidsintensievere productie van sigaren. Als gevolg hiervan was de Engelse arbeidsproductiviteit in tabakswaren veel hoger dan de Westduitse.

In het tweede deel van Hoofdstuk 3 richt ik mij op de verklaringen voor de relatieve economische prestatie van Engeland. De lagere groeivoeten in de Britse industrie werden veroorzaakt door het feit dat (1) Engeland zich dichter bij de technologische grens bevond dan West-Duitsland en (2) er geen ruimte was voor reconstructie of herstelgroei zoals bij het Westduitse *Wirtschaftswunder*.

Er is een hoge correlatie tussen de verschillen in geschatte arbeidsproductiviteit in 1935 en de geëxtrapoleerde arbeidsproductiviteits-verschillen voor het jaar 1960. Dit versterkt het idee dat reconstructie een belangrijke rol speelde in de hoge West-Duitse groeivoeten na de Tweede Wereldoorlog. Echter, West-Duitsland bleef hoge groeivoeten houden ook na het einde van de jaren vijftig. In deze periode was het te verwachten dat West-Duitsland terug zou keren naar een lange termijn groei pad met lagere groeicijfers. Reconstructie kan gebruikt worden als een verklaring voor de snellere groei van West-Duitsland in vergelijking met Engeland tijdens de jaren vijftig, maar niet voor de groei dynamiek gedurende de jaren zestig.

Een andere belangrijke bijdrage van deze dissertatie is dat mijn nieuwe dataset gebruikt kan worden om een belangrijk debat in de economische historische literatuur op te helderen. Mijn nieuwe data en bevindingen werpen licht op de grote vragen aangaande de economische prestatie van Engeland, en stellen mij in staat om aan te tonen dat sommige argumenten die in het debat gebruikt zijn heroverwogen dienen te worden. Mijn conclusie over het moment waarop West-Duitsland het Britse leiderschap in industriële arbeidsproductiviteit overnam verschilt van wat tot nu toe beargumenteerd wordt in de literatuur. In het debat dat in de '*Economic History Review'* werd gevoerd tussen Booth (2003) en Broadberry and Crafts (2003) concludeerde Booth dat bijna twee-derde van de relatieve achterstand van West-Duitsland al in 1952 was ingehaald. Door gebruik te maken van mijn nieuwe dataset ben ik in staat om aan te tonen dat deze uitspraak van Booth onjuist is. De nieuwe cijfers tonen aan dat in 1952 slechts een kwart van de Westduitse verbetering in arbeidsproductiviteit gedurende de periode 1951-1968 bereikt was. Dit betekent dat het vervolg van de jaren vijftig en de jaren zestig nog steeds van essentieel belang is voor het verklaren van de verschillen die er waren tussen de Engelse en Westduitse positie met betrekking tot arbeidsproductiviteit.

In het laatste gedeelte van Hoofdstuk 3 ligt de focus op de mogelijke onderliggende oorzaken van Engelands relatieve economische achteruitgang, zoals het falen in Amerikanisering van management en massaproductie technieken, en het achterblijven van *human capital*.

Na de oorlog is de '*Anglo-American Council on Productivity*' opgezet om Amerikaanse productietechnieken te promoten in Engeland. Het effect van deze inspanningen was echter minimaal. Vanwege de historisch bepaalde voorkeur voor ambachtelijk vakwerk werden pogingen om over te stappen op massaproductie technieken tegengewerkt op de werkvloer. Engelse managers hadden bovendien weinig ervaring met het type controle dat nodig is om met deze methoden te werken en stonden daarom ook niet open voor de adoptie van massaproductie technieken.

Ik heb zogeheten '*manufacturing-footprints*' geconstrueerd om te onderzoeken of grote fabrieken, in termen van het aantal werknemers, in Engeland een ander niveau van productiviteit kenden dan een fabriek van gemiddelde grootte. De nieuwe data tonen aan dat in veel gevallen grote fabrieken een hogere arbeidsproductiviteit kenden dan fabrieken van gemiddelde omvang. Hierdoor kan ik me aansluiten bij de conclusie van Booth (2003a), die beargumenteerde dat er geen sprake lijkt te zijn van falen in *large-scale operations*. Ofschoon er problemen waren met betrekking tot Amerikanisering van de productie en de implementatie van massaproductie technieken geloof ik niet dat we kunnen stellen dat Engeland faalde. Gegeven de situatie, de afwijkende vraagstructuur van de economie en de historische afhankelijkheid van vakmanschap was het simpelweg niet mogelijk om de Amerikaanse technieken direct te kopiëren.

Hoofdstuk 4 gaat over de rol van internationale handel in de Britse relatieve achteruitgang. Engeland was ooit de grootste handelsnatie ter wereld. Na de Tweede Wereldoorlog werd Amerika echter de grootste exporteur van geproduceerde goederen in de wereld. Aan het einde van de jaren vijftig was Engeland zelfs niet meer de één na grootste exporteur van geproduceerde goederen, die rol werd overgenomen door West-Duitsland. Voor Engeland was de *golden age* een periode van protectionisme, gekenmerkt door hoge tarieven. Volgens Broadberry and Leunig (2013) is dit een belangrijke reden voor Engelands trage productiviteitsgroei in de naoorlogse periode. Wanneer we Engeland vergelijken met West-Duitsland dan valt op dat de Britse bedrijven meer verstoken bleven van internationale concurrentie. Europese landen hadden gedurende de naoorlogse periode economische structuren die sterk op elkaar leken. Dit betekende dat bedrijven uit verschillende landen krachtig met elkaar konden concurreren. Engeland handelde echter veelal met landen uit de Commonwealth.

De economieën van de Commonwealth waren echter complementair aan elkaar, als gevolg waarvan de intra-industriële concurrentiekracht laag was.

Ik heb op een gedesaggregeerd niveau onderzocht of er een effect was van internationale handel en openheid op de Britse arbeidsproductiviteit in de periode 1951-1970. De belangrijkste bijdrage van dit hoofdstuk is de kwantificering van de relatie tussen openheid en productiviteit in de naoorlogse periode in Engeland. Ofschoon de wetenschappelijke literatuur de Britse handelspatronen en exportpositie heeft genoemd als een verklaring voor relatieve economische achteruitgang is er weinig kwantitatief bewijs om deze bewering te onderbouwen. Mijn schattingen tonen aan dat openheid inderdaad een effect heeft op de groei van de arbeidsproductiviteit. Met name het niveau van export heeft een aanzienlijk effect op arbeidsproductiviteit.

Het tweede gedeelte van hoofdstuk 4 gaat in op de geografische afkomst van handel. In 1950 was het Sterling gebied nog steeds de belangrijkste handelspartner van het Verenigd Koninkrijk. Gedurende de *golden age* nam het belang van handel met het Sterling gebied langzaam af. Ik heb op een gedesaggregeerd niveau onderzocht of de geografische herkomst van handel een effect heeft gehad op arbeidsproductiviteitsgroei in de industrie. De Britse export naar de Verenigde Staten bleek een groter effect gehad te hebben op groei van de arbeidsproductiviteit dan de export naar het Sterling gebied, Canada en Oost-Europa. Deze bevinding is conform de verwachting op basis van de handelstheorie. Bedrijven en industrieën die exporteren naar Amerika werden geconfronteerd met concurrentie van lokale bedrijven, die opereerden in een goed georganiseerd technologisch regime. Om te kunnen concurreren met deze bedrijven was dus een zeker productiviteitsniveau vereist.

Mijn conclusie is dan ook dat handel inderdaad een duidelijk effect blijkt te hebben gehad op de groei van de arbeidsproductiviteit. De geografische herkomst van handel bleek ook relevant. Deze bevinding impliceert ook dat wetenschappers als Panić and Seward (1966) en Wells (1966), die al in de jaren zestig beweerden dat Engeland had kunnen profiteren van meer handel met de goed ontwikkelde landen, een valide punt hadden. Mijn analyse biedt het kwantitatieve bewijs dat deze bewering ondersteunt. Deze bevindingen sterken het idee dat Engelands relatieve economische achteruitgang deels is veroorzaakt door de keuze voor het handelsbeleid.

Deze dissertatie wil bijdragen aan het voortgaande debat over Engelands relatieve economische achteruitgang gedurende de *golden age of economic growth*. Door middel van nieuwe data zijn we nu in staat om het precieze moment aan te geven waarop West-Duitsland het Verenigd Koninkrijk passeerde in het niveau van arbeidsproductiviteit in de industrie. Ook zijn we nu in staat om aan te wijzen welke industrieën het meest hebben bijgedragen aan het totale verschil in arbeidsproductiviteit in de industrie. In het tweede deel van deze dissertatie heb ik aangetoond dat handel en openheid van bijzonder belang zijn bij de verklaring voor de matige Britse arbeidsproductiviteits-prestaties in de jaren zestig. Voortaan moet Engelands handelspositie worden meegenomen als potentiele verklaringsfactor.

Deze dissertatie kan samengevat worden met de volgende conclusie: Falen is een te subjectief concept in de discussie rondom arbeidsproductiviteit in de Britse industrie. Zoals ik heb aangetoond in deze dissertatie waren er vaak goede gronden voor ondernemers om geen nieuwe productiemethoden op te zetten. De casus rond de textielindustrie in hoofdstuk 3 is hier een goed voorbeeld van. De situatie is enigszins anders als we het hebben over de overheid. Ten aanzien van educatie en handelsbeleid moeten we concluderen dat betere beslissingen tot betere uitkomsten hadden geleid. Zo had een eerdere toetreding tot de EEC gunstiger kunnen uitpakken voor de productiviteitsprestaties van de Britse industrie en daarmee voor de levensvatbaarheid van de industrie op de lange termijn.